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SIR ISAAC NEWTON'S THEORY OF SCIENTIFIC METHOD

I. THE GENERAL NATURE OF NEWTON'S ACHIEVEMENT

NEWTON was not primarily a student of the theory of scientific method, but an active experimental investigator. We are consequently not surprised to discover that there are comparatively few passages in his works in which he discusses, in any connected or systematic fashion, his views of the subject. He was, however, by no means unconscious of the nature of the methods which he was employing, and scattered through his writings there are numerous remarks concerning the matter, from which it is not too difficult to gather his doctrine. When his teaching is thus reconstructed, moreover, it can scarcely fail, despite certain lingering confusions, to strike us as representing a very notable advance. Not only is there abundant evidence that Newton has profited to the full by all that his predecessors have had to say on questions of method, but to a remarkable degree he shows himself capable of separating the gold from the dross, utilizing all that is valuable in their views, and at the same time freeing himself from all that is extravagant, one-sided, or perverse. Moreover, in the clearness and fulness of his grasp of the subject, he goes considerably beyond anything that they have to offer. Indeed to such an extent was he in advance of his age that his followers themselves by no means always grasped the true significance of a point of view which even to us of today still seems quite essentially modern.

Newton's achievement is twofold. In the first place he has completely emancipated himself from the current notion that our understanding of nature can ever reach embodiment in an absolutely certain and definitive science. And in the second place he gives us for the first time a thoroughly clear and well-balanced account, to

say nothing of a brilliant exemplification, of the analytic-synthetic method of mathematical physics.

II. NEWTON AND THE THEORY OF SCIENTIFIC CERTITUDE

In respect of his frank abandonment of the possibility for natural science of any absolute certitude and finality Newton must, however, share the honors with his contemporary Christian Huygens, who had independently arrived at the same position. Huygens expresses his conclusions in the matter in the *Preface* to his *Treatise of Light* (published in 1690, but representing work completed some years before that date), in a passage which also in other respects embodies views akin to those of Newton. "One finds in this subject," he writes, speaking of the physics of light, "a kind of demonstration which does not carry with it so high a degree of certainty as that employed in geometry: and which differs distinctly from the method employed by geometers in that they prove their propositions by well-established and incontrovertible principles, while here principles are tested by the inferences which are derivable from them. The nature of the subject permits of no other treatment. It is possible, however, in this way to establish a probability which is little short of certainty. This is the case when the consequences of the assumed principles are in perfect accord with the observed phenomena, and especially when these verifications are numerous; but above all when one employs the hypothesis to predict new phenomena and finds his expectations realized."[1]

With the spirit of this passage Newton is really in thorough agreement at every point. To one approaching his writings for the first time, however, this agreement will not always be readily apparent; and in fact much confusion has often been felt with regard to Newton's true position in the matter. A careful study can scarcely fail to disclose the real state of his mind; but there are at the same time features of his work which may easily give rise to misapprehensions.

In the first place, the mathematical and deductive form with which Newton increasingly[2] invested his works undoubtedly belies

[1] Translation from *The Wave Theory of Light*, edited by Henry Crew, N.Y., American Book Co., 1900.

[2] "The *Principia* from its first edition (1672) was written on the model of Euclid. The *Opticks* in its successive editions (1704, 1717) became more and

the true spirit of his method, and is only too likely to mislead the reader into supposing that his theory of science is substantially one with that of Descartes. Nothing could really be further from the truth. In fact there are not wanting signs that Newton, apart from the influence of external circumstances, would never spontaneously have chosen to throw his exposition into the strict geometrical form of a system which, starting with a set of definitions and axioms, proceeds to a series of lemmas, propositions and corollaries. In this connection Bloch[3] points to the frequency and length of the *scholia* in the *Principia*. These sections, which interrupt the logical sequence of the demonstration for a variety of purposes, testify to the embarrassment which Newton feels at being confined within that rigid schematism; and it is significant that in one of them he tells us how it was by means of certain experiments which he has just described, and in advance of any formulation of the theory of the matter, that he really discovered, concerning the resistance of fluids, facts which at an earlier stage he has already expounded as necessary consequences of certain theoretical principles.[4]

In the *Opticks* too Newton finds so far unsuitable the mathematical form in which the work is cast that he is obliged to intercalate into his series of deductions sets of experiments which supply the necessary premises of the demonstrations that follow.[5] Moreover, in a notable passage of the third book of the *Principia* he writes as follows: "Upon this subject I had, indeed composed the third Book in a popular method, that it might be read by many; but afterward, considering that such as had not sufficiently entered into the principles could not easily discern the strength of the consequences, nor lay aside the prejudices to which they had been many years accustomed, therefore, to prevent the disputes which might be raised upon such accounts, I chose to reduce the substance of this Book into the form of Propositions (in the mathematical

more geometrical", L. Bloch, *La philosophie de Newton* (Paris, Alcan, 1908) 129.

[3] *Op. cit.* 130.

[4] *Principia*, Book II, Sect. vii, Final *Scholium*, Experiment 4; *The Mathematical Principles of Natural Philosophy*, translated by Andrew Motte (First American Edition, N.Y., 1846) 348: "I began the foregoing experiments to investigate the resistances of fluids, before I was acquainted with the theory laid down in the Propositions immediately preceding."

[5] *Cf.* Bloch, *loc. cit.*

way), which should be read by those only who had first made themselves masters of the principles established in the preceding Books."[6] Newton here tells us, in effect, that demonstration *more geometrico* is so little essentially necessary to the subject that another form would actually be clearer to most readers, and that he had himself at first found it natural to adopt another style of exposition. Why then, we may ask, if this be the true state of the case, did he persist in throwing his work into this more or less uncongenial and misleading form? He himself supplies the answer in the latter portion of the passage just quoted. He had found, namely, by bitter experience, that to present his conclusions merely as a result of experimental investigation did not suffice to produce conviction of their truth. Only by casting his argument in a severely deductive form could he hope to carry with him his more reluctant readers. Hence the procedure which he actually adopted.[7]

In other words, as Bloch sums up the matter,[8] the geometrical mode of exposition is not for Newton a definitive form ensuring a grasp of absolute fact. It is rather a means of persuading those whom dogmatic prejudice renders incredulous, by the use of a language which they find clearer than that of the facts themselves.

Similar polemical motives led Newton frequently to insist in emphatic terms upon the objective character and the certainty of his results as compared with the *a priori* theorizing of his opponents. It is in this connection that he so forcibly protests that his principles are no mere hypotheses, but are rather certified facts. Thus in the *General Scholium* at the end of Book III of the *Principia* he tells us that universal gravitation is no "hypothesis": "gravity really does exist"; "I frame no hypotheses"; "hypotheses . . . have no place in experimental philosophy."[9] It is accordingly

[6] *Principia*, Book III, *ad init. ed. cit.* 383.
[7] *Cf. Bloch. op. cit.* 129.
[8] *Op. cit.* 131.
[9] Motte's translation, new edition revised by William Davis, 3 Vols., London, 1819, II, 314. *Cf. Opticks: or, a Treatise of the Reflections, Refractions, Inflections and Colours of Light.* The Second Edition, with Additions, London 1718, Query 31, 380: "For Hypotheses are not to be regarded in experimental philosophy." Also *Responsio ad Pardies*, Philosophical Transactions, No. 84 [Isaaci Newtoni *opuscula* collegit J. Castillioneus (Lausannae et Genevae, 1744) II 322], where Newton says that his theory of light is not properly to be called an hypothesis, inasmuch as it seems "to contain nothing else than certain properties of light, which I have discovered and regard it not difficult to prove; and if I had not perceived them to be true I would have

quite in the spirit of Newton that Roger Cotes in his *Preface to the Second Edition* of the *Principia* (1713) insists that the "real existence" of gravity "is clearly demonstrated by observations," that "it is plain from the phenomena that such a virtue does really exist,"[10] and characterizes those who "too much possessed with certain prejudices, are unwilling to assent to this new principle" as "ready to prefer uncertain notions to certain."[11]

Such language, if unduly pressed or taken in too literal a sense, may very easily lead us into a serious misapprehension of Newton's true meaning—just how easily we may see from the case of his own contemporary disciples. "The enthusiasm excited by the theory of gravitation, that of the tides, that of sound, that of colors, was an essentially dogmatic enthusiasm. As often happens in the history of the sciences, the pupils and admirers forced the words of the master, and replaced by brutal assertions truths that he had stated with reservations . . . the contemporaries and the disciples of Newton, what formed at the end of the XVIIth century the Newtonian School, accepted the method of the *Principia* as an instrument possessing absolute value. With a boldness and a tenacity that contributed not a little to the success of the Newtonian doctrine, they affirmed that Newton alone was in possession of the true rules of experimentation, that Newton alone had known how to draw from them irrefragable conclusions, that he alone had set science on the road to success."[12] They believed that the *Principia* in its methods and in its results had introduced into physics for the first time an absolute certainty equal to that of algebra or of arithmetic.

Newton himself neither supported nor disavowed these extreme interpreters of his work. Amid the polemics of the day they doubtless powerfully aided his cause. But we must not for all that suppose that he ever allowed them appreciably to affect his own thought. His own much more carefully qualified statement of the matter is to be found, for instance, in his *Fourth Rule of Philoso-*

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preferred to reject them as futile and inane speculation, rather than to acknowledge them as my hypothesis." (Translation from Burtt, E. A. *The Metaphysical Foundations of Modern Science,* New York, 1925, 212.)

[10] Motte's translation, ed. Davis, I xxii.

[11] *Ibid.* xiv.

[12] Bloch, *op. cit.* 465-466.

phising.[13] "In experimental philosophy we are to look upon propositions collected by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions. This rule we must follow, that the argument of induction may not be evaded by hypotheses."

Here it is very evident that Newton regards his conclusions not in the light of certain and finally demonstrated truths, but rather in the light of provisional approximations, possessed, no doubt, of a high degree of probability, but nevertheless open always to revision or correction as a result of further experience. And such is his real opinion throughout. Thus in the *Opticks*[14] he writes: "As in Mathematicks, so in Natural Philosophy, the Investigation of difficult Things by the Method of Analysis, ought ever to precede the Method of Composition. This Analysis consists in making Experiments and Observations, and in drawing general Conclusion from them by Induction, and admitting of no Objections against the Conclusions, but such as are taken from Experiments, or other certain Truths. For Hypotheses are not to be regarded in Experimental Philosophy. And although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions; yet it is the best way of arguing which the Nature of Things admits of, and may be looked upon as so much the stronger, by how much the Induction is more general. And if no Exception occur from Phaenomena, the Conclusion may be pronounced generally. But if at any time afterwards any Exception shall occur from Experiments, it may then begin to be pronounced with such Exceptions as occur."

To the same point is the following passage:[15] "In the last place, I should take notice of a casual expression, which intimates a greater certainty in these things, than I ever promised, *viz. the certainty of Mathematical Demonstrations.* I said, indeed, that the science of colors was mathematical, and as certain as any other part of Optics; but who knows not that Optics, and many other mathe-

[13] *Principia*, Book III, Tr. Motte, First Amer. Edition, 385.
[14] *Ed. cit.*, Query 31, 380.
[15] *Letter to Oldenburg*, July 1672. (Isaaci Newtoni *opera quae exstant omnia commentariis illustrabat* Samuel Horsley, Lond., 1782, IV 342).

matical sciences, depend as well on physical sciences, as on mathematical demonstrations? And the absolute certainty of a science cannot exceed the certainty of its principles. Now the evidence, by which I asserted the propositions of colors, is in the next words expressed to be from experiments, and so but physical: whence the Propositions themselves can be esteemed no more than physical principles of a science. And if those principles be such, that on them a mathematician may determine all the phaenomena of colors, that can be caused by refractions, and that by disputing or demonstrating after what manner, and how much, those refractions do separate or mingle the rays, in which several colors are originally inherent; I suppose the science of colors will be granted mathematical, and as certain as any part of Optics."

III. NEWTON ON HYPOTHESES

But what then of Newton's frequently expressed contempt for "hypotheses"? It must already be clear that his attitude is by no means merely equivalent to that common seventeenth-century feeling that what is merely probable or provisional or approximate (no matter in how high a degree) has no place in a genuine science—which must, on the contrary, possess absolute certainty and finality. But it is by no means equally clear, at first glance, just what he does mean. His condemnatory statements are certaintly very emphatic, and seem to be expressed with a deep conviction of their truth and importance. Yet, on the other hand, we find that "hypotheses" are by no means entirely absent from his own work. We find him for example making use, on occasion, of the supposition that rays of light are really streams of solid particles.[16] Yet at the same time he assures us that this is no fundamental presupposition of his system. It is merely a probable opinion, to the literal truth of which he by no means commits himself—an opinion, moreover, which forms no essential part of his teaching.[17] In another passage

[16] *Opticks*, Query 31, *ed. cit.*, 364: "Even the Rays of Light seem to be hard Bodies; for otherwise they would not retain different properties in their different Sides."

[17] *Letter to Oldenburg*, July 1672. *Opera*, ed. Horsley, IV 324: "It is true that from my theory I argue the corporeity of light, but I do it without any absolute positiveness, as the word *perhaps* intimates, and make it at most but a very plausible consequence of the doctrine, and not a fundamental presupposition, nor so much as any part of it, which was wholly comprehended in the precedent prepositions."

he offers with similar reservations *An Hypothesis Explaining the Properties of Light*:[18] "Were I to assume an hypothesis it should be this, if propounded more generally so as not to determine what light is, further than that it is something or other capable of exciting vibrations in the aether; for thus it will become so general and comprehensive of other hypotheses as to leave little room for new ones to be invented . . . and though I shall not assume either this or any other hypothesis, not thinking it necessary to concern myself whether the properties of light discovered by me be explained by this, or Mr. Hook's, or any other hypothesis capable of explaining them; yet while I am describing this, I shall sometimes, to avoid circumlocution and to represent it more conveniently, speak of it as if I assumed it and propounded it to be believed."[19]

Moreover, whatever his uncertainty with regard to the details of the hypothesis, "it never occurred to him to doubt the existence of a medium which at least performed the function of transmitting light. Amid all their disagreements Newton agreed with Hook to this extent, that there existed an ether, and that it was a medium susceptible of vibrations."[20] In fact Newton propounds the hypothesis of an ether in another connection also. This time he is suggesting, again with some diffidence, a probable explanation of gravitation.[21] And in this case also, despite uncertainty with regard to the details, he was unable, in view of his conviction of the impossibility of action at a distance, ever to relinquish the hypothesis, in some form or another, of an etherial medium.[22] More than this, he "never gave up hope that experimental evidence might eventually be secured which would establish or definitely overthrow some of these specific conjectures" concerning the nature of the ether.[23] "It was in this spirit and to this purpose that he proposed

[18] In a *Letter to Oldenburg*, 25 January, 1675-6, printed in D. Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton* (Edinburgh, Thomas Constable and Co., 1855) I 390.

[19] *Ibid.* 391-392.

[20] E. A. Burtt, *op. cit.* 264. *Cf.* Newtoni *Opera*, ed. Horsley, IV 380.

[21] *Cf. A Letter to the Hon. Mr. Boyle on the Cause of Gravitation*, Feb. 1678-9. *Opera*, ed. Horsley, IV 384: "by what has been said, you will readily discern whether, in these conjectures, there be any degree of probability; which is all I aim at. For my own part, I have so little fancy to things of this nature, that, had not your encouragement moved me to it, I should never, I think, have thus far put pen to paper about them."

[22] *Cf.* Burtt, *loc. cit., et sqq.*

[23] Burtt, *op. cit.* 275.

many of the thirty-one queries attached to the *Opticks*. This judgment of Newton's etherial hypothesis is interestingly confirmed by the last paragraph of the *Principia*." This paragraph runs as follows:[24] "And now we might add something concerning a certain most subtle Spirit which pervades and lies hid in all gross bodies; by the force and action of which Spirit the particles of bodies mutually attract one another at near distances, and cohere, if contiguous; and electric bodies operate to greater distances, as well repelling as attracting the neighbouring corpuscles; and light is emitted, reflected, refracted, inflected, and heats bodies; and all sensation is excited, and the members of animal bodies move at the command of the will, namely, by the vibrations of this Spirit. . . . But there are things that cannot be explained in a few words, nor are we furnished with that sufficiency of experiments which is required to an accurate determination and demonstration of the laws by which this electric and elastic Spirit operates."[25]

We may add to this the fact that Newton, on occasion, actually employs the term hypothesis to designate propositions that undoubtedly do form an integral part of his theory;[26] to say nothing of his reference to the "Copernican Hypothesis,"[27] which he certainly does not reject or regard as superfluous.

Again, so far is Newton's *Opticks* from ignoring hypotheses that the whole argument of the early part of that work consists in showing that current hypotheses concerning light do not explain the facts disclosed by experiment. As a result of successive criticism and rejection of the alternative hypotheses he is led to a new conception of the matter (which we should certainly call a new hypothesis) which is thereupon tested and found to be confirmed by experiment.[28] Furthermore, the appendix to the *Opticks* is wholly composed of a set of *Queries* which are in effect nothing more or less than tentative hypotheses which he had not yet had time to test

[24] Burtt, *loc. cit.*

[25] *Cf. Opticks, ed. cit.* 369: "There are therefore Agents in nature able to make the Particles of Bodies stick together by very strong Attractions. And it is the business of experimental philosophy to find them out."

[26] *Cf. Principia,* Book II, Sect. i, Prop. iv, Scholium, tr. Motte, First Amer. Ed., 257: "But, yet, that the resistance of bodies is in the ratio of the velocity, is more a mathematical hypothesis than a physical one." *Cf.* also the title of Section ix, *Principia,* Book II.

[27] *Principia,* Book II, Sect. ix, Scholium, note 2.

[28] *Cf.* Bloch, *op. cit.* 441, 475.

experimentally, but which he there proposed as worthy of such investigation. And the fact that in successive editions of the *Opticks* this section of the work was constantly expanded[29] seems to indicate that as the years passed he came to attach to it an ever increasing importance.

The truth of the matter is that Newton's polemic against hypotheses is directed not against any and every use of hypotheses, but rather against certain current forms of their abuse. Among these are the following:

(1) In Newton's day many were accustomed to argue for the truth of a theory as follows. There are only a certain number of hypotheses that can possibly explain a given set of phenomena. Now in one way or another it may be possible to show that every one of these hypotheses is false—with one exception. This one exception *must* thereupon be accepted as constituting the true explanation.

Newton protests strongly against such an employment of hypotheses. He points out that such a method of proof is extremely fallacious unless we are absolutely sure that we have really enumerated all the possibilities—and who can be altogether sure on such a point? No, the true method of investigating nature is the experimental. We must establish theories not merely by refuting all the suggested alternatives, but rather by positive and direct experimental confirmation. This is the teaching of the following passage:[30] "In the mean while give me leave, Sir, to insinuate, that I cannot think it effectual for determining truth, to examine the several ways by which the phaenomena may be explained, unless where there can be a perfect enumeration of all those ways. You know, the proper method for enquiring after the properties of things, is to deduce them from experiments. And I told you that the theory which I propounded was evinced to me, not by inferring, *it is thus, because it is not otherwise;* that is, not by deducing it only from a confutation of contrary suppositions, but by deriving

[29] The first edition contained only queries 1 to 7, part of queries 8, 9, 10, 11, queries 12 to 15 and the beginning of query 16. The edition of 1706 adds the end of queries 8, 10 and 11, and queries 25 to 31. The edition of 1717 gives for the first time queries 17 to 24 and the latter part of query 31. *Cf.* Bloch, *op. cit.* 477.

[30] *Letter to Oldenburg,* July 1672. *Opera,* ed. Horsley, IV 320.

it from experiments concluding positively and directly. The way therefore to examine it, is, by considering whether the experiments, which I propound, do prove those parts of the theory to which they are applied; or by prosecuting other experiments which the theory may suggest for its examination."

(2) Closely connected with this first misuse of hypothesis is also the following. If the only way of proving the truth of a theory *were* really the indirect one of *disproving* all the conceivable alternatives, it would follow that no theory could be regarded as adequately established, no matter how good the direct experimental evidence for it, so long as any alternative whatsoever, however devoid of positive grounds, remained possible. Now Newton points out that no matter how well-established by experiment any given theory may be, it will always be relatively easy for an ingenious imagination to construct other hypothetical ways of accounting for the facts—and these hypotheses, however little plausible or probable, cannot be absolutely excluded as at least possible alternatives. But he insists that such considerations should never be allowed to affect our judgment in the least degree. If it were legitimate to reject well-founded theories on *such* grounds, it would forthwith become absolutely impossible for science to reach any results at all.[31] His Fourth Rule of Philosophising (quoted above) is plainly directed against such a use of hypotheses.[32]

[31] *Cf. Secunda responsio ad Pardies,* Phil. Trans., 1672, No. 85, p. 5014, *Opuscula, ed. cit.* II 329: "If any one offers conjectures about the truth of things from the mere possibility of hypotheses, I do not see how anything certain can be determined in any science; since one can always think up other and yet other hypotheses which will seem to furnish new difficulties. Wherefore I judged that one should abstain from considering hypotheses, as from a fallacious argument."

[32] *Cf.* also his reaction to the criticism that he has by no means proved that universal gravitation is the *sole* force at work in producing celestial movements. Even though the law of gravitation be sufficient to account for these motions so far as they are known to us, there may nevertheless be at work also other forces, producing, for example, translations of the whole system, of which the Newtonian theory takes no account. Newton's reply is that hypothetical forces producing merely hypothetical effects may safely be ignored. *Cf. The System of the World,* transl. by Motte in his translation of the *Principia,* First Amer. Ed., 518: "It may be alleged that the sun and planets are impelled by some other force equally and in the direction of parallel lines; but by such a force no change would happen in the situation of the planets to one another, nor any sensible effect follow: but our business is with the causes of sensible effects. Let us, therefore, neglect every such force as imaginary and precarious, and of no use in the phaenomena of the heavens." *Cf.* also Newton's First Rule of Philosophising (quoted below).

(3) A third abuse of hypothesis Newton finds in the procedure of those who, like the Cartesians, having reached their physics by *a priori* construction, refuse thereupon to recognize the validity of any conclusion contrary to their system, even though it be derived by a legitimate induction from careful experimental investigation. This, in Newton's view, is utterly to invert the true order of things. The synthetic or deductive method can itself have no legitimate starting point that is not supplied by analysis and induction. He insists upon the priority, for all natural science, of the latter process; and protests strongly against the rejection of its legitimate results merely because they conflict with dogmatic hypotheses.[33]

The conclusion of Newton's critique of hypotheses is, therefore, in sum, that they are incapable of supplying adequate grounds either for the acceptance or for the rejection of any scientific theory, and that whosoever employs them for this purpose is guilty of an abuse. Scientific theories can be legitimately established by experimental evidence only, and they can be overthrown only (1) by showing the insufficiency of the evidence adduced in their favor or (2) by producing adverse experimental evidence.[34]

We now pass to the consideration of Newton's view as to the *legitimate* use of hypothesis. We may perhaps best sum it up by saying that for him the true function of hypothesis is everywhere suggestive rather than dogmatic.[35] Such, for example, is the utility of those hypotheses which find a place in the Queries of the *Opticks*, to which we have already referred. They serve to direct inquiry, to indicate new lines of investigation, and even to suggest new experiments by means of which science may be advanced.[36]

[33] *Cf. Opticks*, Query 31, *ed. cit.* 380, quoted above.

[34] *Cf. Letter to Oldenburg*, July 1672, *Opera*, ed Horsley, IV 321: "And therefore I could wish all objections were suspended taken from hypotheses, or any other heads than these two: of shewing the insufficiency of experiments to determine these queries, or prove any other parts of my theory, by assigning the flaws and defects in my conclusions drawn from them; or of producing other experiments, which directly contradict me, if any such may seem to occur. For if the experiments, which I urge, be defective, it cannot be difficult to shew these defects; but if valid, then by proving the theory, they must render all objections invalid."

[35] *Cf.* Roger Cotes, *Preface to the Second Edition* of the *Principia*, Motte's translation, ed. Davis, I xiv. Experimental philosophers "frame no hypotheses, nor receive them into philosophy otherwise than as questions whose truth may be disputed".

[36] *Cf. Secunda responsio ad Pardies*, Phil. Trans., 1672, No. 85; p. 5014,

But there is also another use of hypothesis which if Newton does not actively favor he does at least not wholly disallow. Experimental determination of the facts must certainly precede any theories as to their explanation.[87] But once the facts have been duly ascertained Newton by no means entirely forbids the consideration of hypotheses. First of all, we may of course proceed, on the basis of the results experimentally established, to a criticism of current hypotheses and a rejection of all which cannot be reconciled with the facts.[88] But furthermore we may also, if we so desire, permit ourselves to construct hypotheses as to the further explanation of these facts.[89] We have already seen to what extent, and with what reservations Newton himself occasionally indulged in speculations of this kind. But for the most part, and increasingly in his later years, he seems in his own practice to prefer, as far as possible, to refrain from anything of the sort. The considerations which led him to adopt this policy seem to have been as follows. (1) Even if one is able for oneself to resist the inevitable tendency of such hypotheses to become transformed insensibly into dogmas, one's readers are only too likely to misinterpret them. They will be easily led to suppose that these hypotheses, instead of being merely tentative suggestions having a certain probability, constitute fundamental presuppositions of one's system. (2) Moreover, the inclusion of such questionable material leads in prac-

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Opuscula, ed. cit., II 329. "For hypotheses ought to be fitted merely to explain the properties of things and not attempt to predetermine them except so far as they can be an aid to experiments." (Translation from Burtt, *op. cit.* 211, note.)

[87] *Cf.* Preceding note and *Opticks*, Query 31, *ed. cit.*, 351: "For we must learn from the Phaenomena of Nature what Bodies attract one another, and what are the Laws and Properties of the Attraction, before we enquire the Cause by which the Attraction is perform'd." Also *Letter to Oldenburg*, July 1672, *Opera*, ed. Horsley, IV 320: "And this I would have done in a due method; the laws of refraction being thoroughly enquired into and determined, before the nature of colours be taken into consideration."

[88] *Cf. Secunda responsio ad Pardies*, Phil. Trans., 1672, No. 85, p. 5014, *Opuscula, ed. cit.*, II 233: "Postquam proprietates Lucis, his, et similibus Experimentis satis exploratae fuerint . . . , Hypotheses exinde dijudicandae sunt, et quae non possint conciliari rejiciendae."

[89] *Cf. Secunda responsio ad Pardies*, Phil. Trans., 1672, No. 85, p. 5014, Opuscula, *ed. cit.*, II 329: "For the best and safest method of philosophizing seems to be, first diligently to investigate the properties of things and establish them by experiments, and then later seek hypotheses to explain them." "For hypotheses ought to be fitted merely to explain the properties of things and not attempt to predetermine them. . . ." (Translation from Burtt, *op. cit.* 211, note.)

tice to endless and fruitless controversies that had by all means better be avoided. (3) Such dubious speculations, however legitimate from other points of view, form no part of the real business of the positive scientist. It would be therefore better for a scientific treatise to dispense altogether with the consideration of matters more appropriate to the metaphysician.

The latter point is particularly prominent in Newton's mind, and he recurs to it again and again. If he commonly speaks of "attractions and impulsions" as of "forces," "powers" and "causes" of phenomena, he nevertheless frequently warns the reader that these are only conveniences of expression. His real intention is simply to discover by analysis the mathematical relationships which are exemplified in the phenomena, not to ascertain the causes upon which these depend. The nature of his convictions in this matter may be gathered from the following passages. (1) "I design to give only a mathematical notion of these forces without considering their physical causes and seats."[40] (2) "I likewise call attractions and impulsions, in the same sense, accelerative, and motive; and use the words attraction, impulse or propensity of any sort towards a centre, promiscuously, and indifferently, one for another, considering those forces not physically, but mathematically: wherefore, the reader is not to imagine, that, by those words, I anywhere take upon me to define the kind, or the manner of any action, the causes or the physical reasons thereof, or that I attribute forces, in a true and physical sense, to certain centres (which are only mathematical points); when at any time I happen to speak of centres as attracting, or as endued with attractive powers."[41] (3) I shall, therefore, at present go on to treat of the motion of bodies mutually attracting each other; considering the centripetal forces as attraction; though perhaps in a physical strictness they may more truly be called impulses. But these propositions are to be considered as purely mathematical; and therefore, laying aside all physical considerations, I make use of a familiar way of speaking, to make myself the more easily understood by a mathematical reader."[42] (4) "I here use the word attraction, in general, for any endeavour, of what kind so-

[40] *Principia*, Bk. I, Def. viii, Tr. Motte, ed. Davis, I 5.
[41] *Ibid.* 6.
[42] *Principia* Book I, Sect. xi, tr. Motte, *ed. cit.*, I 144.

ever, made by bodies to approach each other; whether that endeavour arise from the action of the bodies themselves, as tending mutually to or agitating each other by spirits emitted; or whether it arises from the action of the aether or the air, or of any medium whatsoever, whether corporeal or incorporeal, any how impelling bodies placed therein towards each other. In the same general sense I use the word impulse, not defining in this treatise the species or physical qualities of forces, but investigation of the quantities and mathematical proportions of them, as I observed before in the definitions. In mathematics we are to investigate the quantities of forces, with their proportions consequent upon any conditions supposed; then when we enter upon physics, we compare these proportions with the phaenomena of Nature, that we may know what conditions of those forces answer to the several kinds of attractive bodies. And this preparation being made, we argue more safely concerning the physical species, causes, and proportions of the forces."[43] (5) "It is true that we may consider one body as attracting, another as attracted; but this distinction is more mathematical than natural. The attraction is really common of either to other, and therefore of the same kind in both. . . . And though the mutual actions of two planets may be distinguished and considered as two, by which each attracts the other, yet, as those actions are intermediate, they do not make two but one operation between two terms."[44]

The mathematical laws of phenomena the scientist can hope to discover;[45] but the ultimate natures of things, or the ultimate causes upon which these depend, may be made the subject of endless hypotheses between which it is impossible to decide by any available evidence. Newton declares repeatedly that it is not his intention to determine anything whatever with regard to these matters.[46]

[43] *Principia*, Book I, Sect. xi, Prop. lxix, Theorem xxix, Scholium, transl. Motte, ed. Davis, I 174.

[44] *The System of the World, Principia*, transl. Motte, First Amer. Ed., 526.

[45] *Cf. Opticks*, Book II, Part III, Prop. viii, *ed. cit.*, 243: "The Rays of Light whether they be very small Bodies projected, or only Motion or Force propagated, are moved in right Lines."

[46] *Cf. Opticks*, Book II, Part III, Prop. xii, *ed. cit.*, 255: "What kind of action or disposition this is; whether it consists in a circulating or vibratory motion of the Ray, or of the Medium, or something else, I do not here enquire." *Ibid.* 256: "I content myself with the bare Discovery, that the Rays

Light, for example, is a "something" that is propagated in accordance with certain mathematical laws. That is all to which he will commit himself.[47] Others may busy themselves with such speculations, if they so desire. It is easy to invent hypothetical explanations,[48] and that too according to a variety of different principles.[49] Some may even find such hypotheses valuable as furnishing imaginary representations by the aid of which their minds more readily grasp the relations of things. Newton in fact does not scruple to throw out frequent suggestions to this end, with appropriate warnings that they are not to be misunderstood.[50] But for the most part

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of Light are by some cause or other alternately disposed to be reflected or refracted for many vicissitudes *Letter to Oldenburg*, Jan. 1672-3, *Opera*, ed. Horsley, IV 350: "But to examine how colours may be thus explained hypothetically, is beside my purpose." (Horsley's text reads "is, besides, my purpose", but this is inconsistent not only with the context but also with the Latin of *Opuscula, ed. cit.*, II 362: "*extra propositum meum est*") "I never intended to shew wherein consists the nature and difference of colours, but only to shew that *de facto* they are original and immutable qualities of the rays which exhibit them."

[47] *Cf. Principia*, Book I, Sect. xiv, Prop. xcvi, Scholium, transl. Motte, first Amer. Ed., 246: "Therefore because of the analogy there is between the propagation of the rays of light and the motion of bodies, I thought it not amiss to add the following Propositions for optical uses; not at all considering the nature of the rays of Light, or inquiring whether they are bodies or not; but only determining the trajectories of bodies which are extremely like the trajectories of the rays." *Cf. Letter to Oldenburg*, July, 1672, *Opera*, ed. Horsley, IV 324-5: "I chose to decline them all" (*i.e.*, all hypotheses), "and speak of light abstractedly as something or other propagated everywhere in straight lines from luminous bodies, without determining what that thing is; whether a confused mixture of difform qualities, or modes of bodies, or of bodies themselves; or of any virtues, powers or beings whatsoever." *Cf. Theory of Light and Colours, Opera*, ed. Horsley, IV 305: "But to determine more absolutely what light is, after what manner refracted, and by what modes or actions it produceth in our minds the phantasms of colours, is not so easy: and I shall not mingle conjectures with certainties."

[48] *Cf. Secunda responsio ad Pardies*, Phil. Trans., No. 85, p. 5014, *Opuscula, ed. cit.*, II 333: "Sed levissimi negotii est accomodare Hypotheses ad hanc Doctrinam." *Cf. Letter to Oldenburg. Opera*, ed. Horsley, IV 350: Newton intended "to leave it to others to explicate, by mechanical hypotheses, the nature and difference of the qualities; which I take to be no very difficult matter."

[49] *Cf. Letter to Oldenburg*, July, 1672, *Opera*, ed. Horsley, IV 324: "But I knew that the properties, which I declared of light, were in some measure capable of being explicated not only by that, but by many other mathematical hypotheses; and therefore I chose to decline them all." *Cf. Secunda responsio ad Pardies*, Phil. Trans., No. 85, *Opuscula, ed. cit.*, II 333.

[50] *Cf. Opticks*, Book II, Part III, Prop. xii, *ed. cit.*, 155: "Those that are averse from assenting to any new Discoveries, but such as they can explain by an hypothesis, may for the present suppose", *etc. Cf. An Hypothesis Explaining the Properties of Light Discoursed of in My Several Papers, Letter to Oldenburg*, 25 Jan., 1675-6, D. Brewster, *op. cit.* I 391-2: "and therefore because I have observed the heads of some great virtuosos to run much upon hypotheses, as if my discoveries wanted an hypothesis to explain them by,

Newton himself has very little interest in this sort of thing. He is occupied with more important matters. Why, after all, should we trouble to seek for more ultimate "causes" when the laws which we have discovered suffice to explain all the phenomena? "We are to admit no more causes of natural things than such as are both true and sufficient to explain the appearances. To this purpose the philosophers say that Nature does nothing in vain, and more is in vain when less will serve; for Nature is pleased with simplicity, and affects not the pomp of superfluous causes."[51]

If Newton exhibits an especial hostility towards hypotheses involving "occult causes" it is perhaps in part because these latter have not even the merit of presenting a precise image to the mind. Occult qualities are mere empty names to disguise our ignorance. As Roger Cotes puts the matter,[52] "some have attributed to the several species of things specific and occult qualities, on which in a manner unknown, they make the operations of the several bodies to depend ... being entirely employed in giving names to things, and not searching into things themselves, we may say, that they have invented a philosophical way of speaking, but not that they have made known to us true philosophy."

The chief passage in which Newton deals with this topic is as

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and found that some, when I could not make them take my meaning when I spake of the nature of light and colours abstractedly, have readily apprehended it when I illustrated my discourse by an hypothesis; for this reason I have here thought it fit to send you a description of the circumstances of this hypothesis, as much tending to the illustration of the papers I herewith send you." *Cf.* the alternative suggestions of *Principia*, Book I, Sect. xi, Prop. xlix, Scholium, tr. Motte, First Amer. Ed., 217 (quoted above); also the suggestion (*System of the World*, tr. Motte, *ed. cit.* 526) that it is as if the planets were bodies held together by a rope: "Two bodies may be mutually attracted to each other by the contraction of a cord interposed."

[51] First Rule of Philosophising, *Principia*, Book III, tr. Motte, First Amer. Ed., 384. Perhaps I go too far in making this latter point. *Cf.* Léon Brunschvicg, *L'expèrience humaine et la causalité physique* 234: "Lorsque l'on pose le problème du point de vue historique, pour le XVII^e^ siècle, on ne voit nullement que, soit Newton, soit l'école newtonienne, ait jamais songé à exclure de la science la recherche des causes. La critique de la relation causale est tout entière l'œuvre de l'occasionalisme cartésien, qui a directement inspiré sur ce point Berkeley et Hume ... *sed causam Gravitatis nondum assignavi.* Newton n'a pas encore résolu le problème de la cause, et il juge antiscientifique de proposer des conjectures, alors qu'il n'est pas en état d'en établir la vérité. Cela ne veut pas du tout dire qu'à ses yeux cette vérité serait sans intérêt intrinsèque ou sans portée scientifique. Cela signifie seulement qu'ayant découvert la formule de la loi, Newton s'est trouvé, ainsi que l'avait Galilée, arrêté devant la question soulevée par cette découverte elle-même: Quelle est la cause de la loi?"

[52] *Preface to the Second Edition* of the *Principia*, tr. Motte, ed. Davis, xiii.

follows: "it seems to me farther, that these Particles have not only a *Vis inertiae*, accompanied with such passive Laws of Motion as naturally result from that Force, but also that they are moved by certain active Principles, such as is that of Gravity, and that which causes Fermentation, and the Cohesion of Bodies. These Principles I consider not as Occult Qualities, supposed to result from the specifick Forms of Things, but as general Laws of Nature, by which the Things themselves are form'd: their Truth appearing to us by Phaenomena, though their Causes be not yet discover'd. For these are manifest Qualities, and their Causes only are occult. And the *Aristotelians* gave the Name of occult Qualities not to manifest Qualities, but to such Qualities only as they supposed to lie hid in Bodies, and to be the unknown Causes of manifest effects: Such as would be the Causes of Gravity, and of magnetick and electrick Attractions, and of Fermentations, if we should suppose that these Forces or Actions arose from Qualities unknown to us, and uncapable of being discovered and made manifest. Such occult Qualities put a stop to the Improvement of natural Philosophy, and therefore of late Years have been rejected. To tell us that every Species of Things is endow'd with an occult specifick Quality by which it acts and produces manifest Effects, is to tell us nothing: But to derive two or three general Principles of Motion from Phaenomena, and afterwards to tell us how the Properties and Actions of all corporeal Things follow from those manifest Principles, would be a very great step in Philosophy, though the Causes of those Principles were not yet discover'd: And therefore I scruple not to propose the Principles of Motions above mention'd, they being of very general Extent, and leave their Causes to be found out."[33] Thus we see that even gravity, electrical attraction, and the like, inasmuch as we know nothing of their ultimate nature or causes, would be nothing but occult qualities, if it were not for the fact that by these terms we understand simply certain mathematically determinate relationships between phenomena, such, moreover, as can be exactly formulated and subjected to experimental testing.

[33] *Opticks*, Query 31, *ed. cit.* 376-7. *Cf.* also *ibid.* 364: "others tell us that Bodies are glued together by rest, that is, by an occult Quality, or rather by nothing." Hence it is that "the moderns, laying aside substantial forms and occult qualities, have endeavored to subject the phaenomena of nature to the laws of mathematics" (*Principia*, Preface of 1686, tr. Motte, ed. Davis, I ix).

"Some . . . are continually cavilling with us, that gravity is an occult property; and occult causes are to be quite banished from philosophy. But to this the answer is easy: that those are, indeed, occult causes whose existence is occult; and imagined but not proved; but not those whose real existence is clearly demonstrated by observations. Therefore gravity can by no means be called an occult cause of the celestial motions, because it is plain from the phenomena that such a virtue does really exist."[54]

Newton's objection to the "occult qualities" of the Scholastics on the ground that they "tell us nothing" reminds us of the similar objections of the Cartesians. Malebranche, for instance, objects to these qualities that they are "vague, general and indeterminate ideas which represent nothing in particular to the mind."[55]

Aristotle, he tells us, "describes and explains everything by those fine words *genus, species, act, power, nature, form, faculties, qualities, cause per se* and *cause per accidens*. His partisans have difficulty in comprehending that these words mean nothing, and that we are no wiser than we were before when we hear them say that fire melts metals because it has the faculty of dissolving, and that a man does not digest because he has a weak stomach or because his digestive faculty (*faculté concoctrice*) is not functioning well."[56]

"These and like ways of speaking are not false, but they really signify nothing. These vague and indeterminate ideas do not lead us into error, but they are entirely useless for the discovery of truth."[57] In a word these are not "clear and distinct ideas," like extension, figure and motion, in terms of which alone the Cartesians explain all the phenomena of nature.

Newton's objection, however, really goes farther than this, for in his view the mechanistic explanations of the Cartesians are in no better case than are the qualities of the Scholastics. They too are "occult" rather than manifest, hypothetical entities lying back of phenomena rather than functional relationships discoverable within phenomena.[58]

[54] Roger Cotes, *Preface to the Second Edition* of the *Principia*, tr. Motte, ed. Davis, I xxii.
[55] *De la Recherche de la Vérité*, Livre VI[e], II[e] Partie, Ch. ii[e], ed. F. Bouiller, II 51.
[56] *Ibid.* 56.
[57] *Ibid.* 56-57.
[58] *Cf.* Bloch, *op. cit.* 419, *sqq.*

In this connection we may pause to enquire what Newton may have meant by those "true causes" (*verae causae*) which he evidently desires to substitute for the occult, and to which he refers, for instance, in the First Rule of Philosophising.[59] The expression has given rise to a good deal of discussion. Herschel, for instance, interpreted the words as signifying "causes recognized as having a real existence in Nature, and not being mere hypotheses or figments of the mind."[60] But Whewell points out that if the rule means, as it has generally been taken to mean, that "in attempting to account for any class of phenomena, we must assume such causes only, as *from other considerations*, we know to exist, then the rule is "an injurious limitation of the field of induction,"[61] inasmuch as it will prevent us from ever becoming acquainted with any new cause.

There seems to be no doubt that when he spoke of "true causes" Newton had in mind principally his own explanation of the motions of the planets by gravitation, as contrasted with the Cartesian explanation by means of vortices. Yet what the *a priori* difference is between the two it is not altogether easy to see. We do know, indeed, that some of the bodies we have occasion to observe—those, namely, near the surface of the earth—are attracted to it. But we likewise know that some of the bodies we have occasion to observe are whirled around in vortices in such media as air or water. Both explanations, therefore, try alike to reach a knowledge of the unknown by assimilating it to some case of the known. Thus vortices also would belong to the class of "true causes" if by these Newton had meant those that have at some time been observed to produce effects of the same sort as the phenomena for which explanation is sought.[62]

It may appear, however, that what Newton meant by a "true cause" was not one *already known* to exist, but rather one the existence of which was *susceptible of independent corroboration.* The latter sentence of the First Rule might lead one to this interpretation. Had Newton said merely that we are to admit no

[59] Quoted above.
[60] Herschel, Sir J. F. W. *A Preliminary Discourse on the Study of Natural Philosophy*. London, 1840, Sect. 138.
[61] Whewell, *Philosophy of Discovery* (London, 1860) 186.
[62] *Cf.* Whewell, *op. cit.* 189.

more causes than are sufficient to explain the phenomena, the rule would clearly be at least decidedly inadequate. For several different combinations of causes, each apparently containing nothing superfluous, might be equally adequate to explain some phenomenon. And yet, as between such rival explanations, we do eventually choose one as representing the true cause of the phenomenon in question. And we do so on the basis of evidence for the existence of the cause it supposes, *other than* that constituted merely by its adequacy to explain the phenomenon in question, *e.g.*, on the basis of its explaining some other sort of phenomenon also, or some other aspect of the same phenomenon not originally contemplated. And the principle governing our choice would here plainly be that of simplicity. Whewell accepts Newton's rule in what appears to be very much this sense when he says: "When the explanation of two kinds of phenomena, distinct, and not apparently connected, leads to the same cause, such a coincidence does give a reality to the cause, which it has not while it merely accounts for those appearances which suggested the supposition."[63] "When such a convergence of two trains of induction points to the same spot, we can no longer suspect that we are wrong. Such an accumulation of proof really persuades us that we have to do with a *vera causa.*"[64] "Newton's Rule, then, to avoid mistakes, might be thus expressed: 'That we may, provisorily, assume such hypothetical cause as will account for any given class of natural phenomena; but that when two different classes of facts lead us to the same hypothesis, we may hold it to be a *true cause*'."[65]

It may well be doubted, however, whether such an interpretation does not exhibit more ingenuity in telling us what Newton *should*

[63] *Op. cit.* 190.
[64] *Ibid.* 191.
[65] *Ibid.* 192. As I have pointed out elsewhere (R. M. Blake, "The Rôle of Experience in Descartes' Theory of Method," in *The Philosophical Review* XXXVIII 207-208), this is the Cartesian conception of a "true cause". *Cf.* also Mill, *System of Logic*, Book III, Ch. xiv, Par. 4, 8th ed., Harpers, 1900, p. 353: "What is true in the maxim is, that the cause, though not known previously, should be capable of being known thereafter: that its existence should be capable of being detected, and its connexion with the effect ascribed to it should be susceptible of being proved, by independent evidence. The hypothesis, by suggesting observations and experiments, puts us on the road to that independent evidence, if it be really attainable; and till it be attained, the hypothesis ought only to count for a more or less plausible conjecture."

have meant by his statements, than success in informing us what he actually *did* have in mind when he wrote them. Another possible interpretation of the matter may therefore here be suggested.

In the passage from the *Opticks* dealing with occult qualities Newton tells us that he employs in their stead "general laws of nature", *i.e.*, formulae merely descriptive of certain relations discernible among phenomena—"their Truth appearing to us by Phaenomena". These, by contrast with occult qualities, are "manifest Qualities, and their Causes only are occult". Now these laws are also characterized as themselves "active Principles . . . by which the Things themselves are form'd" and by which "these Particles . . . are moved". Have we not here the clue to Newton's meaning? If so, the "true causes" of phenomena are determining principles or laws (like the law of gravity) which we can discover by observation and experiment to be actually at work in the world, as opposed to merely hypothetical qualities, or entities (like the Cartesian vortices). It is at least noteworthy that this version of Newton's meaning seems to be that adopted by Cotes in his Preface to the Second Edition. The followers of the Newtonian philosophy, he there tells us,[66] desire "to follow causes proved by phenomena, rather than causes only imagined, and not yet proved. The business of true philosophy is to derive the natures of things from causes truly existent. . . . Therefore if it be made clear that the attraction of all bodies is a property actually existing *in rerum natura*, and if it be also shewn how the motions of the celestial bodies may be solved by that property, it would be very impertinent for any one to object that these motions ought to be accounted for by vortices." "Those rather have recourse to occult causes who set imaginary vortices, of a matter entirely fictitious, and imperceptible to our senses, to direct these motions."[67]

We are now in a position to understand more fully the true significance of the famous passage on hypothesis in the General Scholium at the end of Book III of the *Principia*.[68] "Hitherto we have explained the phaenomena of the heavens and of our sea by the power of gravity, but have not yet assigned the cause of this

[66] *Principia*, tr. Motte, ed. Davis, I xxiv.
[67] *Ibid.* xxiii.
[68] Tr. Motte, ed. Davis, II 314.

power. But hitherto I have not been able to discover the cause of those properties of gravity from phaenomena, and I frame no hypotheses; for whatever is not deduced from the phaenomena is to be called an hypothesis; and hypotheses, whether metaphysical or physical, whether of occult causes or mechanical, have no place in experimental philosophy. In this philosophy particular propositions are inferred from the phaenomena, and afterwards rendered general by induction. Thus it was that the impenetrability, the mobility and the impulsive force of bodies, and the laws of motion and of gravitation were discovered. And to us it is enough that gravity really does exist, and act according to the laws which we have explained, and abundantly serves to account for all the motions of the celestial bodies, and of our sea."

IV. NEWTON AND DESCARTES

It is noteworthy that in this passage Newton exhibits no greater respect for *mechanical* hypotheses than for any others. In the Preface to the 1686 edition of the *Principia* he wrote as follows:[69] "I wish we could derive the rest of the phaenomena of nature by the same kind of reasoning from mechanical principles; for I am induced by many reasons to suspect that they may all depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are either mutually impelled towards each other, and cohere in regular figures, or are repelled and recede from each other; which forces being unknown, philosophers have hitherto attempted the search of nature in vain; but I hope the principles here laid down will afford some light either to that or some truer method of philosophy." These and similar expressions[70] have sometimes been interpreted in such a way as to commit Newton to a strict mechanism after the fashion of Descartes.[71] Such

[69] Tr. Motte, ed. Davis, I x.

[70] *Cf. Opticks*, Query 31, *ed. cit.* 364: "All bodies seem to be composed of hard particles." *Ibid.* 375: "All these things being consider'd, it seems probable to me that God in the Beginning form'd Matter in solid, massy, hard, impenetrable, moveable Particles, of such Sizes and Figures, and with such other Properties, and in such Proportion to Space, as most conduced to the End for which he form'd them."

[71] *Cf.* J. H. Randall, *Making of the Modern Mind*, 1926. Newton was "the man who realized Descartes' dream". He "found the mathematical method that would describe mechanical motion, and he applied it universally. At last what Descartes had dreamed was true: men had arrived at a complete

an interpretation, however, would be quite erroneous. In the first place, this passage expressed, as Newton himself says, merely a suspicion or a hope, not a dogmatic conviction. And in the second place, we know from other passages how little he was prepared to acquiesce in the Cartesian reduction of all the phenomena of nature to differing configurations of material particles possessing purely geometrical properties.

He gives us no mechanistic analysis, for example, of the qualities of hardness and impenetrability. These characteristics of bodies, revealed in sensation,[72] he regards as simple and ultimate properties of matter.[73] Again he regards the mechanistic "explanation" of cohesion as absolutely worthless.[74] Further, after remarking that the ancient atomists had at least the virtue of confining their mechanical explanations within the realm of real corporeal things, Newton contrasts their practice in this regard with that of recent physicists who in their passion for mechanism have vainly invented hypothetical substances—ethers, "subtle matter", etc., in order to force all phenomena into their dogmatic scheme of things. "And for rejecting such a Medium, we have the Authority of those the oldest and most celebrated Philosophers of *Greece* and *Phoenicia*, who made a *Vacuum* and Atoms, and the Gravity of Atoms, the first Principles of their philosophy; tacitly attributing Gravity to some other Cause than dense Matter. Later Philosophers banish the Consideration of such a Cause out of Natural

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mechanical interpretation of the world in exact mathematical deductive terms" (257). For Newton "every event in nature is to be explained by the same kind of reasoning from mechanical principles. . . . The world is a vast perpetual motion machine, and every event in it can be deduced mathematically from the fundamental principles of its mechanical action" (259-260). Randall himself, however, sees the exaggeration of this, and supplies a qualification (263).

[72] For the contrast of Newton with Descartes *cf. Principia*, Rules of Reasoning in Philosophy, Rule III, tr. Motte, First Amer. Ed., 384: "We no other way know the extension of bodies than by our senses." "That all bodies are impenetrable we gather not from reason, but from sensation."

[73] *Cf. Opticks*, Query 31, *ed. cit.* 364: "And therefore Hardness may be reckoned the Property of all uncompounded Matter. At least this seems to be as evident as the universal impenetrability of Matter. For all Bodies, so far as Experience reaches, are either hard, or may be harden'd; and we have no other Evidence of universal Impenetrability, besides a large Experience without experimental Exception." *Cf.* also Third Rule of Philosophising, *Principia*, tr. Motte, First Amer. Ed., 384.

[74] *Cf. Opticks*, Query 31, *ed. cit.* 364: "And for explaining how this may be, some have invented hooked Atoms, which is begging the Question."

Philosophy, feigning Hypotheses for explaining all things mechanically, and referring other Causes to Metaphysics: whereas the main Business of Natural Philosophy is to argue from Phaenomena without feigning Hypotheses, and to deduce Causes from Effects until we come to the very first Cause, which is certainly not mechanical."[75] And as we have seen, although Newton on occasion finds it natural to think of rays of light as streams of solid corpuscles, in the end he absolutely refuses to commit himself even to the belief that light is a material substance at all, to say nothing of giving any more definite mechanistic account of it.[76]

The great contrast which Newton's whole view of science presents when compared with the Cartesian ideal can hardly fail to be already apparent. We may, however, further enforce this contrast by enumerating a few of the important points of divergence.

In the first place, Newton's view as to the origin and nature of the fundamental principles which stand at the beginning of his exposition, in the deductive form in which it is presented, is utterly different from that of Descartes concerning the fundamental principles of *his* physics. For the latter, at least, the primary principles are justified by the light of the intellect—as clear and distinct ideas. For Newton they are one and all of empirical origin, and result from inductive generalization based on experimental data. We have already seen how Newton insists that the use of the analytic method must always precede that of the synthetic, and how he describes the analytic method as consisting in experimentation, observation of phenomena and generalizing induction.[77] In the Preface to the 1686 edition of the *Principia* he writes, to the same effect, that "all the difficulty of philosophy seems to consist

[75] *Opticks*, Query 28, *ed. cit.* 343-4. *Cf. Letter to Oldenburg*, July, 1672, *Opera*, ed. Horsley, IV 335: "And he that shall explicate this case mechanically must conquer a double impossibility." *Cf.* Bloch, *op. cit.* 399.

[76] *Cf. Principia*, Book I, Sect. xiv, Prop. xcvi, Scholium, tr. Motte, First Amer. Ed., 246. Also Book II, Sect. v, Scholium, *ed. cit.* 392-393: "But whether elastic fluids do really consist of particles so repelling each other, is a physical question. We have here demonstrated mathematically the property of fluids consisting of particles of this kind, and hence philosophers may take occasion to discuss that question."

[77] *Cf. Opticks*, Query 31, *ed. cit.* 380, as quoted above; also "By this way of Analysis we may proceed from Compounds to Ingredients, and from Motions to the forces producing them; and in general, from Effects to their Causes, and from particular Causes to more general ones, till the Argument end in the most general. This is the Method of Analysis."

in this—from the phaenomena of motions to investigate the forces of nature, and then from these forces to demonstrate the other phaenomena".[78] In Newton's view, in fact, even the principles of Geometry have an empirical basis—"geometry is founded in mechanical practice, and is nothing but that part of universal mechanics which accurately proposes and demonstrates the art of measuring".[79]

Again, fully to satisfy the Cartesian ideal, a science should reach all its various theorems by deduction from the absolutely certain first principles—the fact that they can be so deduced supplying the fundamental ground for believing them to be true. Even Descartes, in point of fact, is finally forced to concede that no physical science can possibly conform to this standard;[80] and for Newton the case stands throughout far otherwise. In the first place, many theorems owe their immediate origin and proof to experience, and many are only afterwards deductively connected with the first principles.[81] In the second place, the fact that the theorems can be deductively derived from the first principles by no means confers upon them any finality. For the principles themselves, like all conclusions derived from experience, stand always open to the correction of further experimental investigation;[82] and this must in turn be true also of the theorems derived from them—they too must be submitted to experimental control. In so far as they continue to be confirmed by further experiment the grounds for our confidence in their truth are progressively en-

[78] Tr. Motte, ed. Davis, I, x. *Cf.* Cotes, *Preface to the Second Edition, Ibid.* xiv: "There is left, then, the third class, which profess experimental philosophy. These, indeed, derive the causes of all things from the most simple principles possible; but, then, they assume nothing as a principle that is not proved by phaenomena. . . . They proceed, therefore in a two-fold method, synthetical and analytical. From some select phaenomena they deduce by analysis the forces of nature, and the more simple laws of forces; and from thence by synthesis shew the constitution of the rest."

[79] *Ibid.* I ix.

[80] *Cf.* my essay on "The Rôle of Experience in Descartes' Theory of Method" (*The Philosophical Review*, XXXVIII, No. 2, March, 1929, and No. 3, May, 1929).

[81] *Cf. Principia*, Book II, Sect. vii, Scholium, Exper. 4, tr. Motte, First Amer. Ed., 348 (quoted above).

[82] *Cf.* Fourth Rule of Philosophising (quoted above). "Continually he called in experimental verification, even for the solution of questions whose answers would seem to be involved in the very meanings of his terms, such as the proportionality of resistance to density. (*Opticks, ed. cit.* 340.) Having defined mass in terms of density and also in terms of resistance, such proportionality would seem to be involved in the very meaning of the words" (Burtt, *op. cit.* 209).

larged; and they acquire a status higher than any that mere deduction from first principles could ever alone confer upon them.[83] More than this, such further experimental testing also strengthens the evidence for the truth of the first principles themselves.[84]

"In other words, we have no metaphysical guarantee whatever against there appearing exceptions to even our most confidently adopted principles; empiricism is the ultimate test. That this applies to the basic principles of the simplicity and uniformity of nature itself appears from an interesting passage in the *Opticks*. 'That it should be so is very reasonable [*i.e.*, that the theorem of the uniform proportion of the sines applies to all the rays of light], nature being ever conformable to herself; but an experimental proof is desired.' "[85] "No deduction from an accepted principle, no matter how general or clearly derived from past phenomena, can therefore pass for absolutely or physically certain, without careful and continued experimental verification."[86] In fact, if we were to start from our principles, no matter how intrinsically sound, and reason purely mathematically, without further reference to experimental data, we might be landed in palpable absurdities. "There are problems in which an algebraic treatment would lead to the admission of negative densities, imaginary forces, etc., where nature can admit as real only positive magnitudes. Not every mathematical quantity is capable of a physical interpretation. Hence the necessity of keeping close to the experimental facts."[87] Science, whether in its first principles or in its derivative theorems, can

[83] *Cf. Opticks*, Query 31, *ed. cit.* 380-381: "And the Synthesis consists in assuming the Causes discover'd and establish'd as Principles, and by them explaining the Phaenomena proceeding from them, and proving the explanations." *Ibid.*, Book II, Part IV, Observation 12, p. 288: "all which (*sc.* phaenomena), so far as I have yet observed, follow from the Propositions at the end of the third part of this Book, and so conspire to confirm the truth of those Propositions." So much even Descartes is prepared to admit. *Cf.* the account of Descartes referred to above.

[84] *Cf. Opticks*, Book II, Part II, *ed. cit.* 215: "These are the principle Phaenomena of thin Plates of Bubbles, whose Explications depend on the properties of Light, which I have heretofore deliver'd. And these you see do necessarily follow from them, and agree with them, even to their very least circumstances; and not only so, but do very much tend to their proof."

[85] Burtt, *op. cit.* 216. *Opticks, ed. cit.* 66.

[86] Burtt, *loc. cit.*

[87] Bloch, *op. cit.* 436. *Cf. Principia*, Book II, Sect. ii, Prop. x, tr. Motte, First Amer. Ed., 271: "Then the density of the medium would come out as — a/e. But nature does not admit of a negative density, that is, a density which accelerates the motion of bodies; and therefore it cannot naturally come to pass that a body by ascending from P should describe the quadrant PF of a circle."

thus never, in Newton's view, pretend to any absolute finality. It retains to the very end, in some degree, a provisional character.[88]

Not only, however, are the results of science always, for Newton, provisional; they are also always, despite their mathematical form, and the careful use of quantitative methods, only approximately accurate. We all recognize the folly, in the case of mathematical calculations, of carrying them to a pitch of accuracy in excess of what their practical application demands. Newton too is quite aware that absolute exactitude is undesirable where an approximation is sufficient for the purpose in hand.[89] The same principle applies to the formulation of mathematical laws in physics. There is no need to state them in a form more accurate than can be tested by the experimental methods at our disposal.[90] Furthermore, it is a part of Newton's view that a mathematical law of nature, considered in its relation to the actually highly complex occurrences which alone are to be found among natural phenomena, really describes not so much how any actually observed phenomena really *do* occur, but rather how they *would* occur in certain cases of an ideal simplicity. It describes a sort of limiting

[88] How frankly Newton can make use of a purely provisional principle may be illustrated from *Lectiones Opticae,* Pars I, Sect. ii, Par. xliii, *Opuscula, ed. cit.* 118: "Hujus quidem Theorematis certitudinem ab experimentis nondum habeo depromptam; sed cum a veritate vix multum discrepare videatur, nihil veritus sum in praesentia gratis assumere. Posthac forte, vel experientia confirmabo, vel, si falsum invenero corrigam."

[89] We find him employing such expressions as the following: "But since the description of this curve is difficult, a solution by approximation will be preferable" (*Principia,* Book I, Sect. vi, Prop. xxxi, Probl. xxiii, Scolium, tr. Motte, ed. Davis, II, 100). "It will be sufficient if that angle is found by a rude calculus in numbers near the truth" (*ibid.* 102). "And by repeating the computation the place [*sc.* of the body] may be found perpetually to greater and greater accuracy" (*ibid.* 102). "This practice seems expeditious enough, because the angles . . . being very small, it will be sufficient to find two or three of their first figures. But it is likewise sufficiently accurate to answer to the theory of the planet's motions. For even in the orbit of Mars, . . . the error will scarcely exceed one second" (*ibid.* 103).

[90] *Cf.* Bloch., *op. cit.* 282; *Principia,* Book II, Sect. vi, General Scolium, tr. Motte, First Amer. Ed., 318, where it is a case of formulating the mathematical laws governing the resistance of a fluid to the movement of a solid. Newton writes as follows: "But the greatest of the globes I used in these experiments was not perfectly spherical, and therefore in this calculation I have, for brevity's sake, neglected some little niceties; being not very solicitous for an accurate calculus in an experiment that was not very accurate." *Cf.* also *The System of the World,* tr. Motte, First Amer. Ed., 519: "In examining this proportion, we are to use the mean distances, . . . and to neglect those little fractions, which, in defining the orbits, may have arisen from the insensible errors of observation, or may be ascribed to other causes which we shall afterwards explain."

case to which nature is indeed found progressively to approximate, as we consider cases of less and less complexity; but to which, at best, it *only* approximates. In any concrete situation there are always actually at work other factors which must be neglected in stating any one of the simple mathematical laws there involved.[91] These complicating circumstances can afterwards perhaps be explained in terms of further simple laws.[92] Thus in the *Principia*,[93] when he studies the law of the propagation of hydrodynamic disturbances, he speaks of an instantaneous propagation. But it is clear that this instantaneous propagation is only a limit which we substitute in thought for real propagations which are only more and more rapid.[94]

V. NEWTON AND FRANCIS BACON

Sir David Brewster in his *Memoirs of the Life of Newton*[95] writes as follows: "Even Newton, who was born and educated after the publication of the *Novum Organum*, never mentions the name of Bacon or his system. . . . When we are told, therefore, that Newton owed all his discoveries to the method of Bacon, nothing more can be meant than that he proceeded in that path of observation and experiment which had been so warmly recommended in the *Novum Organum;* but it ought to have been added, that the same method was practised by his predecessors; that Newton possessed no secret that was not used by Galileo and Copernicus; and that he would have enriched science with the same splendid discoveries if the name and the writings of Bacon had never been heard of." And Lecky[96] goes so far as to say: "The whole

[91] *Cf. The System of the World*, passage just quoted above.

[92] *Cf. ibid., Principia*, tr. Motte, First Amer. Ed., 512: "But our purpose is only to trace out the quantity and properties of this force from phaenomena, and apply what we discover in some simple cases as principles, by which, in a mathematical way, we may estimate the effects thereof in more involved cases; for it would be endless and impossible to bring every particular to direct and immediate observation."

[93] Book II, Sect. vii, Prop. xxxvii, tr. Motte, First Amer. Ed., 340.

[94] *Cf.* also *ibid.*, Book I, Sect. xi, tr. Motte, First Amer. Ed., 144: "I have hitherto been treating of the attractions of bodies toward an immovable centre; though very probably there is no such thing existent in nature." *Cf.* Bloch, *op. cit.* 447-449. *Cf.* also *Principia*, Book II, Sect. i, Prop. iv, Scholium, tr. Motte, First Amer. Ed., 257: "But, yet, that the resistance of bodies is in the ratio of the velocity, is more a mathematical hypothesis than a physical one."

[95] II, 403.

[96] *History of Rationalism* I 292, note.

method and mental character of Newton was opposed to that of Bacon, and, as his biographer . . . very forcibly contends, there is not the slightest reason to suppose that Newton owed anything to his predecessor."

It is difficult not to feel a certain exaggeration in these statements. True it is that Newton nowhere makes any direct reference to Bacon;[97] but it is nevertheless hard to suppose that no influence from Bacon ever reached him. In fact it would be very strange indeed if he were not to some extent acquainted with the *Novum Organum* itself. Hook and Boyle, with whom Newton was in frequent correspondence, are known as admirers of Bacon. Bacon's works, in the England of that day, were regarded as the fundamental treatise on the logic of science; and it would seem that Newton, during his long years of residence at Trinity College (1661-1696) can hardly have failed to learn something of their teaching.[98] The probability that Newton was to some extent influenced, whether directly or indirectly, by the *Novum Organum* is increased by the fact of a curious correspondence between some of the suggestions of that work and certain of Newton's characteristic scientific results. Bacon, in fact, had already hinted at the existence of something in the nature of gravitational attraction,[99] and had suspected that its force varies with the distance.[100] He also distinctly foreshadows Newton's theory of the tides,[101] and of colors.[102] Furthermore it is very striking to find Newton employing tables of instances in a way strongly reminiscent of the procedure recommended by Bacon.[103] We find also that Newton gives to *Experimentum Crucis* the same somewhat extended interpretation as had Bacon. It is usually described simply as a means of deciding, as between alternative given hypotheses, which alone

[97] It is very strange, however, to find Bloch (*op. cit.* 423, note 2) stating that Newton likewise never refers to Descartes. On the contrary he frequently does so.

[98] *Cf.* Bloch, *op. cit.* 423.

[99] *Novum Organum*, Book II, Aphorism xlv.

[100] *Ibid.*, Book II, Aphorism xxxvi.

[101] *Ibid.*, Book II, Aphorisms xxxvi, xlviii.

[102] *Ibid.*, Book II, Aphorism xxii. For further discussion of the point *cf.* Bloch, *op. cit.* 422.

[103] *Cf., e.g., Isaaci Newtoni Scala Graduum Coloris et Frigoris*, Philosophical Transactions, No. 270 (1701), *Opuscula, ed. cit.* II 417; *Principia*, Book II, Sect. vii, Prop. xl, Scholium; *Opticks*, Book II, Part I, Observations 7, 19; *ibid.*, Book II, Part III, Prop. x; *ibid.*, Book III, Part I, Observations, 3, 9.

answers to the facts of nature. But for Bacon this is not the whole of the matter. If we have already completely enumerated all the possible hypotheses, the experimental refutation of all but one amounts to a demonstration of this one. But if our enumeration, as is often the case, is incomplete, the negative experiments serve to suggest the direction in which it must be completed, and the truly crucial experiment comes only at the end of this process. In Newton's optical researches the crucial experiment occupies a similar position. He first gives an experimental refutation of a number of suggested hypotheses, and as a result of this process is thereupon led to a new suggestion which would not otherwise have occurred to his mind. It is the experiment which verifies this novel hypothesis which Newton, like Bacon, calls *experimentum crucis.*[104] By way of further illustration of the parallelism between Newton's thought and that of Bacon one may compare with Bacon's account of "prerogative instances" Newton's remark:[105] "for it is not number of experiments, but weight to be regarded; and where one will do, what need many." Or with Bacon's emphasis upon "gradual inductions" Newton's statement[106] "By this way of Analysis we may proceed from Compounds to Ingredients, and from Motions to the Forces producing them, and in general, from Effects to their Causes, and from particular Causes to more general ones, till the Argument end in the most general."[107]

In any case, however, whatever the uncertainty of the existence or of the degree of any direct influence of Bacon upon Newton, the foregoing account on the latter's method must already have made it amply clear that the whole spirit of Newton, far from being fundamentally opposed to that of Bacon, is much more closely in accord therewith than with that of Descartes.

[104] *Cf.* Bacon, *Novum Organum*, Book II, Aphorism xxxvi; Newton, *Theory of Light and Colours, Opera*, ed. Horsley, IV 298. "The gradual removal of these suspicions at length led me to the *experimentum crucis* which was this." *Cf.* Bloch, *op. cit.* 440.

[105] *Letter to Oldenburg. Opera*, ed. Horsley, IV 370.

[106] *Opticks*, Query 31, *ed. cit.* 380.

[107] Compare also Newton's "for it would be endless and impossible to bring every particular to direct and immediate observation" (*System of the World*, tr. Motte, First Amer. Ed., 512) or his "In examining this proportion, we are to . . . neglect those little fractions", etc. (*ibid.* 519) with Bacon's "inquisitionem rerum justam et plenam, demptis individuis et gradibus rerum et variationibus minutis (id quod ad scientias satis est)" (*Partis Instaurationis Secundae Delineatio et Argumentum, The Works of Francis Bacon*, ed. Ellis, Spedding and Heath, VII, 45).

There are, nevertheless, important differences between the two men. First of all, for Bacon observation and experiment, together with the consequent inductions, form practically the whole of scientific method; whereas in Newton's view, as we have seen, these procedures, however important and indispensible, form but one phase or stage of the full analytic-synthetic method. In the second place, even within this phase of the method there is a very significant difference between the induction of Newton and that of Bacon. The Newtonian induction, namely, proceeds throughout in quantitative terms; it employs exact measures, and its propositions are cast in numerical and mathematical form. Whatever the virtue of Bacon's precepts concerning the employment of definite measurements and numerical computations,[108] it must be evident that Newton went far beyond his predecessor in his understanding and practice of such procedures. This is nowhere more plainly to be seen than in the contrast between Newton's employment of tables of instances and that of Bacon. The phenomena which the latter lists in these tables are never defined in any exact quantitative manner nor submitted to any numerical measurement. Consequently the tables, although they may form the basis upon which we can establish the existence of certain vague correspondences between phenomena, never permit us to state these correspondences as mathematical equations. They may show us that certain natural phenomena are functions of certain others, but they can never reveal to us the precise form of those functions. Newton's tables, on the other hand, are always tables of *numerical quantities* determined by exact measurement; and they lead to the discovery of mathematically determinate functional formulae.[109]

Finally, there is another great difference between the two men in the fact that Bacon is still under the illusion that the right method will give us scientific results of absolute and final certainty, an illusion from which Newton is completely free.[110]

[108] *Cf. Novum Organum*, Book II, Aphorism viii: "And inquiries into nature have the best result, when they begin with physics and end with mathematics. Again, let no one be afraid of high numbers or minute fractions."

[109] *Cf.* Bloch, *op. cit.* 429, *sqq.*

[110] Compare, *e.g.*, Bacon's "not pretty and probable conjectures, but certain and demonstrable knowledge" (*Novum Organum*, Preface, last paragraph), or "a form of induction which shall . . . lead to an inevitable

VI. NEWTON'S RULES OF REASONING IN PHILOSOPHY

We have already quoted the first and the last of the famous four *Rules of Reasoning in Philosophy* with which Newton introduces the third book of the *Principia;* and we have also seen something of their bearing. The second and third of these rules, together with Newton's comment upon them, run as follows:[111] "Rule II. Therefore to the same natural effects, we must, as far as possible assign the same causes. As to respiration in a man and in a beast; the descent of stones in *Europe* and in *America;* the light of our culinary fire and of the sun; the reflection of light in the earth and in the planets.[112] "Rule III. The qualities of bodies which admit neither intension nor remission of degree, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever. For since the qualities of bodies are only known to us by experiments, we are to hold for universal all such as universally agree with experiments; and such as are not liable to diminution can never be quite taken away.[113] We are certainly not to relinquish the evidence of experiments for the sake of dreams and fictions of our own devising; nor are we to recede from the analogy of Nature, which uses to be simple, and always consonant with itself."[114]

The First Rule is simply the familiar rule of simplicity, together with the precept about *verae causae* discussed above. The Second is one of various ways of stating the principle of the uniformity

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conclusion" (*The Great Instauration,* Plan of The Work, *The Works of Bacon,* ed. Ellis, Spedding and Heath, VIII 42) with Newton's "although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions" (*Opticks,* Query 31, *ed. cit.* 380).

[111] *Principia,* Book III, tr. Motte, First Amer. Ed., 304-305.

[112] Burtt, *op. cit.* 214, comments as follows: "The later more mathematical expression of this principle is that where different events are expressed by the same equations, they must be regarded as produced by the same forces." So also Bloch, *op. cit.* 456.

[113] The restriction of the application of this rule to "qualities which admit neither intension nor remission of degree" is curious. Bloch thinks that Newton thereby intended to exclude from the application of the rule such properties as viscosity or friction. These properties are susceptible of more or less, and what can decrease indefinitely may in the end disappear altogether. It would therefore be rash to attribute these properties to the minute particles of matter. So too resistance decreases as rarefaction increases. It would therefore be rash to attribute this property to such a rarefied medium as the ether. Bloch, *op. cit.* 462-463.

[114] This expression is frequently repeated by Newton. *Cf. Opticks,* Book I, Part I, Prop. vi, *ed. cit.* 65-66; Query 31, *ed. cit.* 351-372. We omit the illustrations of the application of this rule, which Newton here adds.

of nature; in this case, with special reference to the use of that principle as the foundation of conclusions by analogy. The Third Rule seems to be no more than a reformulation of the first two, with reference to another set of conclusions.[115] It seems obvious that in bringing before our minds these notions of the simplicity and uniformity of nature, Newton has in mind not so much any general theory of the matter, as the utility of these principles for the defense of his own system against various forms of objection.[116] He nowhere gives us any more definite statement concerning either the precise meaning of these rules, or the grounds upon which we are justified in assuming their truth.[117] Neither does he give us any further analysis of analogical arguments, nor any more detailed account of the nature of inductive generalizations, the principles and methods involved, or the canons of their validity.

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[115] R. Cotes in his *Preface to the Second Edition* of the *Principia* (1713), tr. Motte, London, I xxi-xxii, states the substance of the second and third rules as follows: "This axiom . . . is received by all philosophers, namely, that effects of the same kind, that is, whose known properties are the same, take their rise from the same causes, and have the same unknown properties also. . . . All philosophy is founded on this rule; for if that be taken away we can affirm nothing of universals. The constitution of particular things is known by observation and experiments; and when that is done, it is by this rule that we judge universally of the nature of such things in general."

[116] *Cf.* Whewell, *op. cit.* 185-186: "Thus the first Rule is designed to strengthen the inference of gravitation from the celestial phenomena, by describing it as a *vera cause,* a true cause; the second Rule countenances the doctrine that the planetary motions are governed by mechanical forces, as terrestrial motions are; the third rule appears intended to justify the assertion of gravitation as a *universal* quality of bodies; and the fourth contains, along with a general declaration of the authority of induction, the author's usual protest against hypotheses, levelled at the Cartesian hypotheses especially."

[117] Upon this point Burtt comments as follows (*op. cit.* 215): "Are these apriorisms speculative assumptions about the structure of the universe, which make it always possible to reduce its phenomena to laws, especially mathematical laws; or were they to Newton a matter of method merely, to be used tentatively as a principle of further inquiry? It is perhaps impossible to answer this question with absolute confidence. At those times when the theological basis of Newton's science was uppermost in his mind, it is probable that he would have answered substantially as Galileo and Descartes did. But in his strictly scientific paragraphs the emphasis is overwhelmingly in favour of their tentative, positivistic character, hence the fourth rule of reasoning in philosophy . . . must be regarded as imposing definite limits on all of the other three." *Cf.* Burtt's comment on the Fourth Rule (quoted above).

THE PROBLEM OF THE SELF

THE most general problems concerning the self are, it would seem, three: (1) its "inner nature"; (2) its distinction from and relation to the organism with which it is most specifically associated; and (3) its distinction from and relation to the world at large. The three successive portions of this paper will be concerned with these three problems in order.

I. THE NEGLECTED 'I'

All contemporary theories of the self suffer from what I cannot but think to be a fatal defect, in their consideration of it as merely an object among objects, and their neglect of that element which is the one distinctive character of selfhood—namely, its character as *Subject*. Whether we think of the self as identical with the body, as the integration of psychical experience, or as an immaterial soul-substance, we are in any case using categories which are applicable only to objects, and so are totally inadequate to that which is primarily not object at all, but subject. If, for example, we are to think of the self as the integration of its states, the question inevitably arises, 'What am I who know this integration?'—and similarly with the other theories; no answer being forthcoming within the limits of the theory under consideration. That the self is an object is a truth not under dispute, the present contention merely being that it is more than an object, and that this 'more'—its subject-character—is the most important thing about it.

This assertion that the self is fundamentally a subject can make no claim to originality, and may not itself seem to be of any profound importance; but this is because the full significance of it has rarely if ever been given proper consideration. Of recent and contemporary philosophers, Gentile alone seems to make much of this truth; but to him the only true Subject is the Absolute; the finite self, so far as it can be distinguished at all from the Absolute, being merely an object. To most writers the self is simply an object which happens to be able to be conscious of itself and of other objects, and as such is casually referred to as 'the subject of experience', but treated after all as merely an object. In other words,

for present-day philosophers in general, 'I' do not exist, but only my 'self' as an object which happens to be of special interest to 'me'.

Now this neglect of the 'I' is a serious matter. A subject is not merely a special kind of object, but an entity of a radically different character from any object—one which *as* subject can never be known, never be a datum of experience, and yet is an inevitable presupposition of experience, and as such an ineradicable element of reality. When Hume looked for his 'self' among his 'perceptions', he was indeed looking in the dark for a non-existent black cat; and yet in his very description of his vain search was assuming—not merely implicitly, but explicitly, though unrecognizingly—the only self worth searching for. "When *I* enter most intimately into what *I* call myself, . . . *I* never observe anything but" "some particular perception or other", and "never can catch myself at any time without a perception".[1] It is not surprising that he found no such self, since no such self exists—but who is this 'I' that failed to find it?

The key to the correct answer to this persistent question is to be found, I think, in the word used a moment ago—the word 'presupposition'. The self as object is a fact of experience like any other object—the object of that particular form of experience known as self-consciousness; but in every kind of experience, the self as subject is (not found, but) presupposed, and whatever must be presupposed if experience is to be possible at all must be accepted as real as assuredly as that which is discovered in and by means of experience. This conception of the subject-self as that which is presupposed in experience I beg leave to call the transcendentalist conception of the self; this theory being marked off from all others by its threefold insistence on (*a*) the primary importance of the subject-side of the self, (*b*) the radical metaphysical difference between a subject and any object whatsoever, and (*c*) the fact that the 'I' or self as subject is not a datum of experience but a presupposition thereof.

Nor is it merely, or even chiefly, in an intellectualistic sense that the innermost self is to be described as subject rather than object. 'I' am not only a Knower, or subject of experience, but

[1] *Treatise of Human Nature,* Book I, Part IV, Section vi. Italicization altered.

also a Will, or subject of activity. It is in the neglected 'I', not in the organism or the object-self, that the property of freedom is to be found; and it is the 'I' which is the only genuine principle of individuation in man. The experience of finite selves may conceivably be thought of—whether truly or not is another question —as merged in the experience of the Absolute; but I am I, and Thou art Thou, and the Absolute is the Absolute—no merger of Subjects is conceivable. Royce made this clear long ago, when in his defense of Absolutism against the attacks of Howison he showed that though the same contents may form parts of various individuals, the Will of each individual, which is the true principle of individuation, is unique and irreplaceable.[2]

But though our emphasis in this paper is on the subject-character of the self, we recognize of course that in its completeness the self is both subject and object in one, *i.e.*, a Subject-Object. As such, selves or persons are fundamentally distinguished from things, which are merely objects; the distinction of entities being not between objects and subjects, but between pure objects and subject-objects, since a 'pure subject' is impossible. Transcendentalism, then, does not teach that there is within us any 'pure' or 'hard Ego' existing separately from and in addition to the 'empirical ego' or self of ordinary experience. William James once remarked, in his inimitable way, in criticism of the Kantian and the usual post-Kantian view, that "Transcendentalism is only Substantialism grown shame-faced, and the [transcendental] Ego only a 'cheap and nasty' edition of the [substantial] soul".[3] But this thrust passes harmlessly aside from the transcendentalism of this paper, since it misses the entire point of the self as subject, distinguished as such from all 'pure objects'.

As thus explained, our theory can readily be defended against any charge of dualism as between the subject- and the object-self; for these are not two separate selves, but two aspects of one self. Similarly as to the fear that the transcendentalist conception makes the knowledge of one's own 'inner self' impossible. The theory nowhere implies or condones a contrast between a real but unknowable subject-self, and a knowable object-self which is,

[2] *The Conception of God*, by Royce, Howison, and others (1897): *Supplementary Essay*, by Royce (esp. 259 and 269 f.).
[3] *Principles of Psychology*, I 365.

however, mere appearance. The real self is subject-object, and when known is known in its reality as object. It is true that 'I' (the subject) can know only 'Me' (the object), but it is only one self that knows (as subject) and is known (as object). I can *know* only Me—yes; but I *am* I, which is a far more significant proposition. Employing the terminology of S. Alexander, without pretending to attribute to him my doctrine: I contemplate myself as object, I enjoy myself as subject. Or, in the language of C. A. Richardson, though again somewhat modifying his thought: "I am *acquainted with* [objects, including Me]; but . . . I *'realize'* myself [as I], for I *am* myself".[4] In other words, the 'I', not being an object of knowledge, is not known empirically; but as the necessary presupposition of any knowledge at all, it may be said to be known transcendentally, *i.e.*, "enjoyed", "realized", or lived.

Let no one, therefore, hurl at us the "cheap and nasty" charge (if I may be allowed to divert James's language to my own purposes), all too common today, of mysticism or obscurantism; for though the nature of the self is indeed mysterious and obscure, so also is, after all, the nature of everything else. But, however it may be with other things, that I, the subject of experience, am, as something more than a mere object of knowledge, is surely an ineluctable truth, whose denial but carries with it its own affirmation.

There is another point regarding the self, however, which must not be omitted from our account, namely, that the self is in its essential nature (*i.e.*, as 'soul') not a thing or phenomenon, but a noumenon—a member of the realm of ends or spiritual values, rather than a mere fact or existent. The self as the psychologist studies it (my 'mind') is but an 'integration' of feelings, desires, and ideas; but surely this is not all that 'I' am—rather am I a system of values, a centre of purposes, a pursuer of ideals. Consciousness as the psychologist studies it, again, is a mere meaningless 'stream' of phenomena, as is nature to the natural scientist; it is Spirit alone that can give meaning to this stream—whether the spirit that pervades nature, or the spirit which 'I' most truly am. Transcendentalism, then, interprets the phenomena of mental

[4] *The Supremacy of Spirit*, 15.

life as expressions of a deeper spiritual life which transcends them, and gives them meaning, purpose, and value. Here again no dualism is implied between these so-called 'realms'; noumena are not separate existents, coördinate with and severed from existent phenomena—they *are* these phenomena as most profoundly interpreted, interpreted from the axiological point of view.[5] My soul is not another self from my mind; it is 'myself', in the most intimate sense of that word.

II. I AND MY BODY

Up to this point we have considered the self as a purely immaterial entity. But the self, as we know it in this life at least, is embodied. What is the relation then between the spiritual self and the physical organism with which it seems to be so intimately associated? With this question we reach the second of our three main problems.

I shall not here attempt to examine all the various familiar theories of the mind-body relation, but merely state that on this matter transcendentalism stands firm on the central platform of the double-aspect theory—that mental and cerebral processes are ultimately identical, that the same process which I experience as mental would be experienced by an outside observer with the proper sense-organs and instruments as physical. To those who hesitate to accept this position on the ground that mental and physical phenomena are empirically so diverse that it is inconceivable that they should be 'really' identical, advocates of the general doctrine offer various analogies—such as the concave and convex sides of a shield, the mass and surface of a solid body, etc. Still more striking, and significant for our purpose, is the situation regarding visual and tactual space-perception. Between the appearance to the eye of a block of ice, for example, and its feeling to the hand and arm in touching and lifting it, there is not one feature in common; and yet we recognize it immediately as one block of ice, even if we but look at it from a distance without touching it, or handle it with closed eyes. So it is with the

[5] See Bosanquet "On the True Conception of Another World"; reprinted in *Science and Philosophy, and Other Essays*, esp. 325.

mind-brain relation: however diverse these may seem to be, in reality they are identical.

The mental-physical distinction, therefore, is a purely phenomenal one, what is the reality of which these are phenomena? To this question there are four answers before the philosophical world: (1) *Spinozism*—that mental and physical phenomena are coördinate and equally real "attributes" of one substance; (2) *Neo-Realism*—that they are coördinate complications of "neutral elements"; (3) *Epiphenomenalism*—that only physical phenomena are real, and consciousness but a passive accompaniment of brain-processes; and (4) *Panpsychism*—that all reality is psychical, and physical phenomena but the outward manifestations of such psychical realities. Without considering in detail the merits and defects of each of these varieties of psychophysical monism, two general points stand out for our consideration: (*a*) that panpsychism alone among them specifically allows, as any adequate account must allow, for the active character of mind as a positive force in evolution and human life; and (*b*) that all four of them interpret the self solely in terms of substance, neglecting the higher category of Subject altogether. All the current theories, therefore, are deficient in one degree or another from the standpoint of transcendentalism; by adopting the distinctions drawn in the first section of this paper, however, these defects may readily be overcome, without losing any of the value of the general double-aspect theory.

Transcendentalism, then, as we use that term,[6] regards mental and cerebral processes as coördinate parallel objective manifestations of the 'I' or Subject-Self. It thus agrees with Spinozism as to the relation between mind and brain, but differs in subordinating both of these to the Subject as their unitary Ground. In other words, the double-aspect concept, for transcendentalism, applies to the relation between mind and brain, but not to that between subject- and object-self—nor, as we shall see later, to that between the noumenal and the phenomenal self. Mental phenomena, for our theory, are the expressions of myself ('I') to myself ('Me'); my body being the instrument by means of which I manifest my-

[6] See *Rifts in the Universe*, by the writer of this paper (Yale University Press, 1927), esp. 22-29 and 54-56.

self to the world at large; and yet these are but two aspects of one object-self, Mind-Body, which express in different ways the reality of a single Subject. The brain, of course, is the immediate correlate of the mind; but it is through the behavior of the organism under the control of the brain (including language as the most significant form of behavior) that I manifest myself to the world outside.

For transcendentalism, too, a distinction must be made between mind, soul, and spirit. These two latter terms are not fashionable in present-day philosophical discussion, but they are needed nevertheless, if we are to do justice to all the complexities in the nature of the self. Mind, like body, belongs to the phenomenal order; but spirit is a noumenal or non-phenomenal entity, and soul a denizen (as it were) of both worlds. I may be conscious of my spiritual nature as clearly as I am of my body; and yet, as spirit belongs to an entirely different order of reality from body, so consciousness of spirit belongs to an entirely different order of consciousness from consciousness of body. In other words, there are within me two fundamentally distinct kinds of consciousness: phenomenal consciousness, or the awareness of phenomena, mental as well as physical, including my own mind-body; and spiritual (noumenal) consciousness, or the awareness of noumena, such as God, other selves, my own soul, and the "spiritual values". Mind is the integration of phenomenal consciousness, and spirit the integration of spiritual consciousness; but both of these are aspects of the one soul, expressions of the one 'I'.

Mind and body, we have said, belong to the phenomenal order: both also are objects merely. Spirit, however, is primarily, though of course not wholly, subject. In other words, when we speak of the self as primarily subject, we are referring to the noumenal, not the phenomenal, self—spirit, not mind-body. That is to say, again, spirit alone is 'I', but it constitutes a part of the 'Me' also; whereas mind-body belongs to the object-side of the self only.

As to the relations which subsist among the various elements of the self, the phenomena of the body in their interrelations are amenable to causal explanation, and so with mental phenomena in their interrelations; but the interrelations between mental and physiological phenomena are those of concomitance merely, even

though interpreted ultimately in terms of identity. Spirit, furthermore, being a non-phenomenal entity, a system of purposes, its inner activities are related to one another not causally at all, but teleologically; spiritual consciousness as it goes on in this life has, no doubt, psychophysiological (*i.e.*, phenomenal) conditions which are amenable to scientific investigation, but there is always a residuum not so amenable. Again, the relation between the subject- and the object-self is an absolutely unique relation—that of ground to expression, or of agent to instrument. Transcendentalism, therefore, does not merely substitute an interactionism of 'I' and 'Me' for the interactionism of mind and body; since the former relationship is decidedly not a causal one, as interactionism holds the mind-body relation to be. Finally, all these relationships, except those within the mind and within the physical continuum, being non-causal, are therefore outside the realm of science altogether, and are subject-matter for metaphysical investigation only.

In addition to the superiority which advocates of this theory may claim for it over other theories of the mind-body relation as an explanation of that relation itself, it has also two other advantages, extraneous, perhaps, but nevertheless important. These are (1) the elimination, by the adoption of this theory, of the historic problem of the seat of the soul; and (2) the support which it offers to the doctrines of freedom and immortality. The mind being for transcendentalism merely the inner aspect of the brain, and the soul, so far as it is distinguishable from the mind, belonging to an entirely different order of reality, the idea of location is inapplicable to either. This advantage transcendentalism holds in common, it is true, with all other monistic theories of mind-body, the problem of the seat of the soul being of significance only for interactionism; but the second merit is distinctive of transcendentalism among the various interpretations of the double-aspect theory, though in this case interactionism also possesses the same superiority.

Religiously-minded dualists[7] have always contended that any monistic philosophy, such as is implied in the double-aspect theory, makes human freedom and immortality impossible. This is cer-

[7] As, for example, J. B. Pratt. See his *Matter and Spirit*, Chapter vi.

tainly true of any theory which identifies mind with soul as well as with body, but not of our own theory, which *distinguishes* the two former. As all monistic theories admit, mental and bodily phenomena alike, being subject as they both are to natural laws, and being but aspects of one reality in any case, necessarily live and die together; but this does not affect one way or the other the eternal value or spiritual significance of these phenomena as represented by the soul. Freedom and immortality are attributes of the soul in its spiritual aspect, not of the mind. The spirit uses the mind-body as an instrument for carrying out its free purposes in the world of phenomena, but it is not dependent on its instrument for its own existence. True, these considerations do not prove either freedom or immortality; but they do show that transcendentalism is as compatible with these doctrines as is interactionism.

Only spirit, however, or soul in its spiritual aspect, can conceivably be regarded as immortal; phenomenal consciousness, and the mind which is its integration, dies with the body, of which it is merely an 'aspect'. After death, then, if the soul survive at all, the distinction made just above between soul and spirit disappears; soul and spirit become identical, and mind as a distinct element ceases to exist. What survives is still Subject-Object—I, and my spiritual Me; only the phenomenal Me, Mind-Body, perishes.

Transcendentalism, then, may, I think, fairly claim to combine the advantages of interactionism and of the double-aspect theory, without suffering under the defects of either, and so to be a genuinely synthetic account of the mind-body relation.

III. I AND THE WORLD BEYOND

It has long been customary, particularly among idealistic philosophers, to make a fundamental distinction within the universe of reality between the Self and the Not-Self or world beyond the self. This egocentric division of reality is a perfectly natural one. It is hardly to be wondered at that every individual should view the world from his own particular position in time and space, making himself the centre from which the whole universe (including himself) is observed, and regarding the distinction between himself and everything else as of special significance. What-

ever may be thought about the metaphysical importance or unimportance of this distinction, it is certainly of prime importance to the individual.

But where is the dividing line between these two elements of reality to be drawn? In the previous sections of this article we have assumed that this line was clear and definite, and have investigated the nature of the self without considering its relation to and distinction from that which lies beyond. The distinction, however, is by no means simple; on the contrary, the line between self and not-self is constantly shifting. I may have no doubt that my inmost feelings are a part of myself, and that the nebula in Andromeda, for example, is definitely beyond me; but what about my home, my friends, my country? Why do I call them 'mine'? And is it after all a foregone truth that even the distant nebula is entirely and unambiguously *not* mine? The fact that we can ask these questions seriously is a sufficient proof of our duty to take them into consideration before we leave our general topic of the nature of the self.[8]

This our third problem (as outlined in our introductory paragraph) may best be approached by pointing out two meanings of 'self', as we consider it in its relation to the 'not-self': (*a*) the 'individual self', the self as contrasted with the not-self; and (*b*) the broader or (as we may call it) 'relational self', the self as interrelated with its manifold environment. The former corresponds in a general way to the Subjective Spirit of Hegel, the latter to the second and third moments in the evolution of Spirit. In the narrow, psychological and metaphysical, sense, the self is separated from the rest of the universe, the latter being regarded as alien; but in the broader, ethical and religious, sense, all reality is in some degree part of the self, and there is no absolute not-self. 'I am a self', says the enlightened soul, 'and nothing that exists is alien to me'. From this standpoint, unselfishness means 'broader-self-ness'—the sacrifice not of the self to the not-self, but of the individual to the relational self.

The individual self, with which alone we were concerned in the two previous sections of this paper, is divided, we may remind

[8] For an early study of this matter, see William James, *Principles of Psychology*, I 291-329.

ourselves, into (*a*) the Subject-Self or 'I', and (*b*) the Object-Self or 'Me'. The latter includes furthermore (i) the spirit, or 'Spiritual Me'; (ii) the mind, or 'Psychical Me' as we may now designate it; and (iii) the body, or 'Physical Me'. How these parts or aspects of the individual self are related to one another we have considered in our second section; we may therefore pass on at once to the subject of the *relational self*.

As already defined, this is "the self as interrelated with its manifold environment". More precisely, this environment is threefold: material, social, and spiritual; and each of these divisions is again complex. The whole environment we may denominate the 'Mine', to distinguish it from the 'Me' of the individual self, and at the same time to emphasize its close affiliation with the latter: and we shall discuss each of the first two aspects of the Mine under three corresponding sub-heads: (*a*) relations with individuals, (*b*) relations with limited groups of individuals, and (*c*) universal relations within the field under consideration.

The Material Mine, then, is the self in its relation to its material environment, so far as it regards the latter as not really alien, but in some vital fashion a part of itself. In its completeness, the material environment comprehends the entire physical universe; but within this vast field two lesser portions must first be discussed.

First of all we note that there are certain individual 'things' which to each of us constitute in a very real and literal sense parts of ourselves; this is true in a sense, indeed, of all 'my property', all things that 'belong to me'; but the intimacy of 'mine-hood' is not attached equally and indifferently to everything that happens to be recognized as legally my own, but more specifically to certain things in which I have a more or less sentimental interest—keepsakes, souvenirs of travel, heirlooms, the products of my individual efforts or earnings, etc. To lose one of these is truly to lose a 'part of myself', which would decidedly *not* be true of the loss of some piece of property with which I have no personal associations, as we significantly put it.

The second subdivision of the 'material mine' consists of the various *places* with which I have intimate associations—my local relationships, we may call them. These include my home—the

actual physical place where I live, with all its powerful affiliations; my country—the geographical entity so called, rather than the institution; or any portion of this for which I have a special affection—Dixie, New England, Devonshire, or what not. Persons differ tremendously, of course, in the degree in which they are attached to places, but 'breathes there a man with soul so dead' as not to feel this kind of a tie to *some* extent? To be deprived of my home, or exiled from my country, means to such a one a serious despoliation of selfhood.

Finally, the material self in its broader reaches is not restricted by any local boundaries, but extends to the outermost confines of the physical universe. To the lover of Nature, the trees and flowers immediately around him, the ocean and mountains which he observes from afar, even the 'starry heavens' in their unimaginable aloofness—to the *lover* of nature, I say, all these are truly a part of himself, and to be deprived of any of them (as, perhaps, by blindness) is an irretrievable loss. This aspect of the 'mine' we may call also the 'aesthetic self', since it is only so far as I can see myself in physical objects outside me that I can appreciate whatever beauty resides therein.

The Social Mine has been called by Palmer[9] the "conjunct self", the self as inherently a member of society, the self as being what it is only through its conjunction with other selves. It also corresponds fairly well to Hegel's realm of Objective Spirit. If the 'material mine' in its universal relationships is the aesthetic self, so this may be called throughout its entire range the 'ethical self'. The narrowest field of the individual's social activities is found in his relations to other individuals, his personal relationships as we ordinarily call them, *i.e.*, his relations with members of his family, his friends and acquaintances, etc. It is needless to point out how truly these, or at least some of these, are parts of oneself, and not merely external objects; and how poignantly their loss is felt to be a real loss of selfhood. Next come the institutions of society, as distinguished from other individual selves —one's family as a unit, one's business or profession, the Church, and the State. Patriotism is love of country—not merely as a geographical entity, as we considered it before—but as an in-

[9] See especially *The Nature of Goodness*, Ch. vi; and *Altruism, its Nature and Varieties*, Ch. i.

stitution which demands the loyalty of its citizens. *My* country, we call it, my church, or my family; and in so naming them, we claim these institutions as parts of ourselves, and ourselves to be 'members' of these larger wholes. Finally, as in the material realm, so in the social, nothing short of the universal—in this case, Humanity at large—satisfies the requirements of complete selfhood. The obligation of loyalty is not restricted to the bounds of family, tribe, or nation, but extends to the four corners of the earth; and wherever I find a human being, there I find also myself.

Last of all we come to the 'Spiritual Mine' or 'religious self'—in Hegelian terms, the realm of Absolute Spirit. God is *my* God, and in so calling Him I am claiming Him for myself. God, furthermore, being the spiritual centre of the universe, religion, in seeking for the personal union of the human soul with God, is seeking for the final orientation which constitutes the ultimate goal and completion of selfhood.

Looking back now over our study of the various meanings of the self, we can see how freely the boundary between self and not-self shifts, along (as it were) latitudinal lines. If we take these meanings in the order in which we have discussed them, we shall see that this is the order both of diminishing intimacy, as we may call it, and of increasing breadth, in our understanding of selfhood. The 'I' is undoubtedly 'self' in the most intimate sense of the term; the object-self is less intimate than the subject, the body than the mind, the relational self than the individual, and so on. The broadening out of the self, however, does not involve any loss in the reality of that self, or in the appropriateness of the term to each stage; on the contrary, the spiritual status of any self is to be tested according to its capacity for regarding what is less intimately mine as being nevertheless really a part of 'myself'. Thus one who thinks of himself as merely a body, or as a bare individual, or of his own country but not other countries as his; or of humanity as a part of himself but of God as an alien Being (believed in, perhaps, but not worshipped); falls short just so much of what a complete self should truly be. 'I am a self', we repeat in closing, 'and nothing which exists—natural, human, or divine—is alien to me'.

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A DEFINITION OF AESTHETICS

IN HIS "Foreword" to E. F. Carritt's *Philosophies of Beauty* D. W. Prall writes:[1]

> Aesthetics is in fact only a pseudo-science or pseudo-philosophy, a study that no self-respecting member of an academic faculty can safely devote himself to exclusively, or even mainly. Its subject-matter is such wavering and deceptive stuff as dreams are made of; its method is neither logical nor scientific, nor quite whole-heartedly and empirically matter of fact; and its results are an unhappy jargon, no worse than others in its infelicities and incomprehensibility, but without application in practice to test it and without orthodox terminology to make it into an honest superstition or a thorough-going, soul-satisfying cult. It is neither useful to creative artists nor a help to amateurs in appreciation. It shifts from Hegelian 'moments' to 'empathic responses', from bits of minute critical analysis to irrelevant rhapsodic effusions, from 'the principles of aesthetic form' to the 'materials of beauty', from the media of the arts to the nature of tragedy or the sublime in nature. It uses the terms of all the arts and sciences as well as those of literary study and criticism and history. In an essay on aesthetics, value, for example, may mean one sort of colour variation, or the price of a picture, or 'any object of any interest'. And to make the confusion complete, it has been said that the 'home' of all values is God, and that God is irradiated in all beauty. Aesthetics is thus accurately designated in Spinoza's 'asylum of ignorance'. No wonder it is shunned and a little feared.

With this challenge in mind we are confronted in Carritt's excellent volume with excerpts from the writings of seventy-four persons, both ancient and modern, who have dared to address themselves seriously to the solution of a problem which, as Prall goes on to admit, "will not down". And respect, at least, must be given to the names that appear in this list; for, beginning with Xenophon, it includes such giants of the mind as Plato, Aristotle, St. Thomas Aquinas, Leibniz, Berkeley, Hume, and Kant.[2]

Not, however, until an obscure German professor of philosophy gave his attention to the subject did 'aesthetics' gain a name as a separate and distinct discipline. Alexander Gottlieb Baumgarten (1714-62) in his *Habilitationsschrift*[3] defended a thesis previously propounded by Leibniz, and coined the word *Aesthetik* to name

[1] Oxford University Press, 1931. ix f.

[2] One notes the absence of an excerpt from Gustav Theodor Fechner, the founder of experimental aesthetics.

[3] *Meditationes philosophicae de nonnullis ad poema pertinentibus* (1735).

the inferior faculty of sensuous as distinct from the higher faculty of rational knowledge.

Leibniz had written (1684):

> An obscure or vague idea is one that does not suffice for the recognition of its object. . . . If I can recognize the thing, I have clear or vivid knowledge of it, but this again may be either confused [sensuous] or distinct [intellectual]. It is confused if I cannot enumerate one by one the marks which suffice for distinguishing the thing from others. . . . Thus we see painters and other artists well enough aware what is right and what is faulty, but often unable to give any reason for their taste: if asked, they reply that the work they dislike lacks a *je ne sais quoi*.[4]

It is customary to say of Baumgarten, as, indeed, Carritt does,[5] that his positive contribution to Aesthetics was slight. The excerpts Carritt gives are from three works in Latin, one of which was called *Aesthetica* (1750). It is probably true that Baumgarten's works were little read, and, as the commentaries upon them indicate, are dull and pedantic in tone.[6] Yet the Leibnizian idea which Baumgarten developed into a special subject of study seems to deserve more consideration than has usually been accorded it in defining the field.

Generally speaking, the subject of beauty, as distinct from truth and goodness, did not await Baumgarten's suggestion of a name; and most writers on the subject have simply accepted the name as an appropriate designation for the philosophy (and psychology) of beauty, or of beauty and ugliness. But Leibniz was not primarily concerned with a definition of beauty; neither was Baumgarten. Rather, they were concerned with the distinction of two ways of apprehension: an intellectual way in which one can "enumerate one by one the marks which suffice for distinguishing the thing from others", and the aesthetic way in which apprehension is and must remain sensuous and "confused" (*repraesentatio confusa*).

The Greek term from which Baumgarten coined his word means *perception*, but it means a perception that rests heavily on feeling as distinct from knowing.[7] This distinction has a profound psy-

[4] Carritt 57.
[5] Carritt, 81.
[6] *Cf.* Johannes Schmidt, *Leibnitz und Baumgarten, ein Beitrag zur Geschichte der deutschen Aesthetik* (Halle, 1875), and Max Schasler, *Kritische Geschichte der Aesthetik* (Berlin, 1872) 347 f.
[7] *Cf.*, the writer's *Psychology and Education*, New Edition, revised in collaboration with Frank S. Freeman, 1932, Chapter vii, on Perception.

chological significance, though modern schools of psychology have done their best to obliterate it. In an effort to be 'exact' and 'scientific', modern psychology has chosen an analytic method of approach which has led to the two opposed schools commonly known as those of "existentialism" and "behaviorism". The first would analyze experience into all its varying kinds, and by approved methods of classification put sensations, affections, images, and even thoughts into their appropriate categories. From this point of view 'feeling' and 'knowing' as modes of apprehension are simply eliminated from all consideration, since it is the 'whats' and not the 'hows' that concern the 'existentialist'. The 'behaviorist', disdaining experience as such, attempts to establish a science of psychology out of materials which at first glance one might think belonged more properly to physiology. The emphasis placed upon the employment of such terms as *stimulus, response,* and *conditioned reflex,* points to an analysis of behavior without reference to any 'feeling' or 'knowing' of what may be happening.

There is, to be sure, another psychology of more ancient lineage which still has its advocates, and which insists on treating psychology as a functional inquiry. Here feeling and knowing are familiar rubrics; but it is questionable if mind can interact with body in a 'scientifically' functional manner.

Not until the advent of *Gestalttheorie* did the possibility of a science of psychology in functional terms become apparent; the gist of *Gestalttheorie* being its denial that science prescribes 'elements', either of conscious data—experiences—or of units of action—reflexes. The organismic conception of physiological action puts the elements of muscle, nerve, and gland in the category of abstractions, and, instead of supposing that a living organism is a machine made up of individual and discretely acting parts, proposes the view that an organism acts, both to begin with and throughout its life, as a total unit of behavior. By growth and learning, this total unit acquires such partial patterns of behavior as it may, by individuating appropriate organs to satisfy its own internal demands as a dynamic unity. The conjuring word *integration* thus comes to mean a two-sided process in which parts are not only assembled, but modified, and even created, under the exigencies of a situation which demands satisfaction or comple-

tion in terms of conditions both internal and external to the organism.

According to *Gestalttheorie* the phenomena of experience are of no scientific interest *per se*, since they are in essence experiences *of behavior*. Organisms always feel, and may also know, what they are about. This is a postulate which, when universalized to include all living creatures, is based upon analogical reasoning. It is precisely that to which Leibniz refers as "clear or vivid knowledge", which may be either "confused or distinct". Whence comes this experience of behavior is a metaphysical question which we shall not attempt to answer. But the postulation of its existence as described, that is, as a phenomenon which finds its true correlative in physiological action, raises an epistemological question which cannot lightly be set aside. If experience indubitably exists for me, and if I fail to know at once whence it comes because it always points beyond itself to something of which it is but the phenomenon, then by what reason, other than a postulate of faith, can I be sure that it is not there positively of its own right without reference to the actual or moving existence of that to which it points? The reason which holds me from a sheer positivistic view of these phenomena is that the conditions of my experience transcend the experience itself. If I am unwilling to accept these conditions as existing apart from me and my own reflections upon them, I can find no basis for my customary expectations and their fulfilments. Thus a postulation of experience *per se* is inadequate to my needs, whereas a postulation of experience as the criterion of my behavior is adequate.

Turning to behaviorism, it appears that there is nothing in this term which contradicts our postulate. But whereas many behaviorists, including the coiner of the name, John B. Watson, deny the scientific validity of experience altogether, our postulate accepts it as the one criterion which defines psychology as distinct from physiology and its biological associates. In other words, psychology is the study of behavior by means of experience.

Finally, our postulate raises functional psychology to the level of a scientific inquiry, by its refusal to accept an interaction of mind with body, or teleological consequences of a mental guidance for bodily functions; such guidance and such functions as

there are being implicit in the behavior itself. The 'values' which attach to it as right and wrong, good and bad, beautiful and ugly, are simply inherent.[8] It therefore follows that behavior can no longer be regarded as the manifestation of a machine. Instead, the organs of behavior, the brain especially, possess an equipotentiality of function which makes the outcome of behavior unpredictable in the mechanical terms of interplaying parts, and requires instead a conception of field-dynamics in which masses obey impulses and attain resultant states of dynamic equilibrium which sometimes override the influence of preformed organs with set ways of action.

An existential functional behaviorism of this order brings back to the term feeling, or aesthetic, the significance which Leibniz truly descried, and upon which Baumgarten attempted to build. But, to quote Prall, though we moderns are more enlightened,

> What science in the Authorized Version cannot tell us we refuse to know. And science cannot yet say how we came to have eyes to see with, nor just how, having eyes, we do see colours and shapes through them, nor how our ears manage to hear the chords of music. How then can we respect a study the very data of which must be found in intuition—intuition which is itself only the word for the fact that we do so find data—a science the method of which is utterly unsettled and all of its results so indeterminately stated that we cannot be quite sure of their meaning, much less of their general bearing?[9]

If the 'Authorized Version' of the science of psychology were either existentialism—which is on the wane—or behaviorism—which has also shot its bolt—then the hope for a definition of aesthetic studies would be still remote. But, fortunately, that is no longer our situation. The contribution of *Gestalttheorie*, together with the even more powerful contribution of organismic theories of biology, is rapidly changing the present outlook of all life-sciences. Even inanimate physics is less secure in the exactness of its analytical methodology than a few years ago when some thought that all the major work in this field had been done.

But though the age-old distinction of *perception* from intellection again finds a proper place in scientific discussion, the definition of

[8] *Cf.* the writer's article "Learning as Improvement", *American Journal of Psychology* (1927) XXXIX 235 f. According to Santayana, "Values spring from the immediate and inexplicable reaction of vital impulse, and from the irrational part of our nature"; *The Sense of Beauty.* (Carritt 198.)

[9] Carritt xi.

Aesthetics—of an art no longer inferior, though genetically prior to the arts of discernment—is still a matter of continual achievement rather than a *fait accompli*. Aesthetics, as here conceived, embraces not only the pursuit of beauty, including all artistic endeavor and its appreciation; it embraces as well all technique and craftsmanship. The means whereby a carpenter planes a board until it is smooth and level, the technical proficiencies of mechanicians, sportsmen, printers, and so on, are no less aesthetic than those of the artist who creates and the connoisseur who enjoys paintings, music, and literature. Since our definition of the aesthetic applies to the faculty of intuition, as Prall calls it, it must include all those behaviors, both recipient and executive, the details of which cannot be enumerated without disrupting the activity that is going forward. The well-known illustration of this fact is given in one's inability to walk in a straight line whilst attending to the specific movements of one's legs. Such attention to the parts destroys the 'melody' of the movement as a whole. And yet one can and must discern the object or goal, the straight line one is treading. Discernment, or knowing, is something superimposed upon feeling or perceiving. We can have discernment and feeling at the same time, for feeling furnishes knowing a natural background or general criterion of what is going on. We also have feeling with little or no discernment, and we can have discernment in a logical essay where feeling has become so attenuated that in operations with signs and symbols the background of bodily resonance is held largely in abeyance. It is not well to forget, however, the genetic priority of feeling. The aesthetic criteria of behavior are those chiefly employed by animals other than man, and by man himself, not only in his early stages of life where they are dominant, but throughout his career. One may venture the opinion that it is because of this fundamental animal method of gaging behavior in terms of its fitness, that man in his intellectual state of development still finds need for that beauty of perfection in things seen and done which can be felt, but not known.

Yet to describe this need is not to explain either its meaning or its general bearing. What, indeed, can one say positively for a science which is rooted in the indiscernible? If Aesthetics is concerned with both art and craft, surely there is much that goes into

the products of both artist and craftsman which requires steady discernment and enumeration. So, too, the critic of these products exercises his skill in a very articulate and discerning manner, often to the quite justifiable distress of the artist and builder.

In so far as Aesthetics is a science it must deal discerningly with those products of behavior which are aesthetically or undiscerningly conceived and carried out. Aesthetics therefore, like any other science, is critical. Its distinction rests in this, that its data are not themselves discernible items, like genes or atoms, but are instead rhythms and designs in which a special regard for their wholeness must always be had. When it comes to a discernment of partial patterns of behavior and their occasion, the aesthetician must either turn over his problem to a special science in which it can be adequately handled, or he must borrow from this source enough relevant information to warrant his conclusions.

Aesthetics is of necessity a border-line science, which does not always know its own boundaries. Yet with its highly special criterion of feeling one's way through to a desired end, it has an indubitable field of operation which is a major concern neither of psychology nor of any natural science. Its distinction from psychology is obviously less clear than from other sciences, partly because psychology is itself less sure of its own definition. But the fact remains that both artistic production and skill can be 'psychologized' with little or no reference to that intrinsic phenomenon of the fitness of things which makes the 'inferior' knowledge of Baumgarten a real datum of current behavior.

Consider the following observation of Socrates in the *Philebus:*

> I do not now intend by beauty of shapes what most people would expect, such as that of living creatures or pictures, but, for the purpose of my argument, I mean straight lines and curves and the surfaces of solid forms produced out of these by lathes and rulers and squares, if you understand me. For I mean that these are not beautiful relatively, like other things, but always and naturally and absolutely; and they have their proper pleasures, no way depending on the itch of desire. And I mean colours of the same kind, with the same kind of beauty and pleasures.[10]

Whether or not an erudite psychologist would follow up this suggestion in an effort to determine what these forms are, which we intuit so successfully as elements of sheer beauty, is beside the

[10] Carritt 30.

point. Here, at any rate, is an aesthetic problem, the solution of which can in no wise be given by a geometry of indifferent measurement. It is a simple datum of intuition, as Prall says, that certain proportions have qualities which others lack. A critical analysis partly reveals the interest which attaches, say, to the oblong with the proportion of the golden sector. When defined logically this proportion is sheer geometry; but it also has an aesthetic significance which is something else. Thus, we cannot say that all oblongs, the proportions of which are such that the width is to the length as the length is to the sum of these two dimensions, must be beautiful. We can, however, say that this proportion lends a distinct interest to such a figure, and with the aid of geometry we can analyze the reasons why it is interesting.

The reasons are mainly two:

(1) As regards the dimensions themselves, two lines in this proportion will have the greatest possible *individuality;* for the proportion is such that the longer line in relation to the shorter has the optimal effect of an elongation which differs as much as possible from the shorter line without approaching its double length. In other words, in comparing any two linear extensions we tend to regard the shorter as a unit. The logical tendency is therefore to regard the longer as something more than this unit or something less than two units, something more than two units or less than three units, and so. The greatest degree of individuality which can attach to a succession of units in which simple multiplication is set aside is provided by the proportion: a : b :: b : a + b.

(2) As regards the area of this figure, it is divisible into two parts, one of which is a true square, and the other a reciprocal of the figure itself, that is, an oblong on end which has the same shape as the original figure. Since this reciprocal is in turn divisible in the same way, we have the possibility of a succession of divisions each one cutting off a true square as its 'gnomon' and constituting what has been called the 'whirling-square' rectangle. The movement of these squares defines a spiral which, according to Jay Hambidge, has been generously employed in the patterns of Greek vases.[11]

[11] *Cf. Dynamic Symmetry* (1920); also Edward B. Edwards, *Dynamarhythmic Design* (1932).

This illustration should serve to show what an aesthetic problem is like, wherein it demands a special methodology of research, and how its facts can be stated with the aid of logic so as to escape the indeterminateness of which Prall makes his complaint.

The trouble with most aesthetic inquiries and the results they attain is that they are mainly concerned with a reduction of the aesthetic to logic. Those who approach the subject from a philosophical position are concerned to define beauty as over against logic and ethics. The aesthetic thus becomes a *judgment,* which is a contradiction in terms, because what, for instance, the whirling-square rectangle means aesthetically is a felt and not a known proportion. Our knowledge, in this case, is obtained logically like any other knowledge; but only serves to explain the basis of an aesthetic apprehension which is not enhanced, and may be destroyed, by the very logic of analysis that reveals the reason of the effect.

Similarly those who approach the problem by way of a psychological experiment are inclined to reduce their materials to such bare elemental factors that an enumerative method of analysis is the only one the observer can employ. As remarked by Bishop Berkeley:

> The architects judge a door to be of a beautiful proportion, when its height is double of the breadth. But if you should invert a well-proportioned door, making its breadth become the height, and its height the breadth, the figure would still be the same, but without that beauty in one situation which it had in another.[13]

Instead of following Berkeley's line of thought that the door on its side "would not yield convenient entrances to creatures of a human figure"—a line of thought which, by the way, has proved more common than fruitful in the explanation of psychological phenomena—we maintain that the immediate total effect of the proportion in its setting is what makes it aesthetically satisfying, and not the mere proportion apart from any relevant context, or with sole reference to a customary usage.

In the same way, the aesthetic effectiveness of skill, and the fact that feeling one's way through an activity is the only way in which one can ever learn to be skilful, are quite other than the calculat-

[13] Carritt 76 f.

ing approach of the craftsman to his task. It is a logical but not an aesthetic distinction that we make when we assert in the words of Oscar Wilde that "the only beautiful things are the things that do not concern us".[13] Significant as this saying is, it draws a practical not a theoretical distinction. Practically we distinguish artist from artisan. Practically, we look for beauty in the creations of the artist, rather than in the constructions of the artisan. There is actually much more kinship in the artist and the artisan than we are wont at times to consider. Both are in effect technicians, who rely upon their aesthetically apprehended skill to carry them on to the completion of their respective tasks. As Lascelles Abercrombie remarks:

> When a poet chooses his subject—or I had better say, when a subject chooses a poet—there is no necessity for beauty to have any say in the business: but there is absolute necessity for every subject which poetry successfully communicates to us, to have thereby become invested with beauty.[14]

The investment with beauty distinguishes the work of the artist from that of the artisan. Both, however, may achieve the same end, the one wittingly, the other unwittingly. A poet, though he may follow his technique as unwittingly as any mechanician, knows nevertheless that the garment of beauty must be thrown over his creation. The mechanician, though aesthetically guided, expects but a resultant means to some ulterior end. This distinction, important though it be, is not an aesthetic distinction, but one of judgment. The effect of any technical product may be beautiful or ugly, useful or useless; and it may have qualifications of both kinds. Distinction rests on the fact that beauty is felt, and utility is known. The emphasis upon feeling characterizes pure art, and upon knowing, mere utility.

[13] *Cf. The Decay of Lying;* also, from Kant's *Critique of Judgment,* the excerpt by Carritt (p. 111): "Taste is the faculty of estimating an object or a type of idea in respect of satisfaction or dissatisfaction without any interest. The object of such satisfaction is called *beautiful.*"

[14] *Cf. The Theory of Poetry* (1924) 44. A. C. Bradley writes in similar vein: "If the poet already knew exactly what he meant to say, why should he write the poem? The poem would in fact already be written. For only its completion can reveal, even to him, exactly what he wanted. When he began, and while he was at work, he did not possess his meaning; it possessed him. It was not a fully formed soul asking for a body: it was an inchoate soul in the inchoate body of perhaps two or three vague ideas and a few scattered phrases" (Carritt, 226 f.).

As we have defined it, Aesthetics is the science of felt behavior. The field of study includes whatever an organism does, the criterion of which is an immediate experience uncontaminated by enumerative discernment. Thus, rhythm and design are the two terms we conjure with in giving an aesthetic description of our actions. But in order to justify the employment of these terms it is necessary to seek their implications by rational discernment. In so far as Aesthetics is a science it is as logical in its method and results as any other. The fact remains that its datum is an 'intuition', and not itself a result of reason or analytic prescription. Further, the analysis it undertakes in seeking the grounds for a feeling of fitness is always functional and never structural. The aesthetic intuition is never the compulsory result of a calculating procedure. If Poe actually composed "The Raven" as he describes the process in his well-known essay on "The Philosophy of Composition", that fact will explain the defects rather than the merits of his achievement. No doubt the artist knows what he is about, and employs his technique as means to an end, yet his criterion of excellence is not his knowledge but his sensibility to the figure of his composition as a whole. And it is this sensibility which makes of him an artist and not merely an artisan.

By recourse to Baumgarten's original use of the term, it seems possible to give a definition to Aesthetics which goes some way towards determining its problems in a manner which will counter the charge that it is "only a pseudo-science or pseudo-philosophy, a study that no self-respecting member of an academic faculty can safely devote himself to exclusively, or even mainly"; for if, as is generally admitted, the subject "will not down", and if, as Leibniz pointed out, there is a real difference in knowledge that "may be either confused [sensuous] or distinct [intellectual]," then the problem of accounting for the confused effects of immediate apprehension apart from enumerating "one by one the marks which suffice for distinguishing the thing from others" is quite as real and quite as reputable an undertaking as the more cogent, but at the same time more artificial, procedure of rationalization.

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DISCUSSION

BERGSON'S CONCEPTION OF FREEDOM

THE *Science News Letter* for April 4, 1931 contains the following statements, which preface A. H. Compton's summary of a lecture he gave recently: "Only because the world in a physical sense is not wholly reliable can it have any human meaning. . . . This important philosophical deduction from the new principles of physics, introducing a new discussion of 'free will', is expected to cause great interest." The lecture dealt with the flexibility that Heisenberg's theory posits. According to Heisenberg, "the resolution of the paradoxes of atomic physics can be accomplished only by further renunciation of old and cherished ideas. Most important of these is the idea that natural phenomena obey exact laws—the principle of causality." Compton's own experiments "are partly responsible for this dramatic reversal of the physicist's point of view". The reason for the abandonment of the law of causality is that "any observation of the present state of a system disturbs that system". Consequently, one cannot exactly predict its future state. Thus, for example,[1] if an ideal observer were equipped with the means for seeing or photographing an electron, he would be able to locate it with a precision dependent upon the length of the light-wave illuminating it, the shorter ones making for greater accuracy. The reason is that "an electron cannot emit or reflect light without undergoing an *abrupt* and *discontinuous* change in its velocity". Thus one cannot assume with classical mechanics that, if one knew the state of an isolated mechanical system at one o'clock, one could predict completely its state at two. "The new quantum mechanics enables one to predict the probability of the state of a system at two o'clock if one knew the probability of its state at one o'clock." Hence there is "indeterminism at both ends of the equation".

These new developments in physical theory must interest all thinking persons. The experimental substantiation of the view that there is flexibility in the physical world is thought-provoking. Since, however, Heisenberg "has based his uncertainty principle upon the limitations inherent in physical measurements",[2] I am not yet certain whether the flexibility posited by the holders of the quantum theory implies any more than that we cannot know enough about the electron to forecast its course. Compton seems to mean more than this by *indeterminateness*, but just what he means is not clear. He says, "Consider the action of a beam of X-rays on the air through which it passes. The X-rays are

[1] I turn, at this point, to follow an exposition of the matter given in an article by W. H. Williams on "Determinism and Indeterminism in Quantum Physics", *The Personalist* X 4. Where I do not quote, I follow his explanation closely.

[2] W. H. Williams, *op. cit.* 245.

found to eject electrons from the air at high speed. Each electron is observed to proceed in a different direction from every other. The question arises, when the air is first exposed to the X-rays, in what direction will the first electron be ejected". His answer is that the probable direction can be determined on the basis of many observations but the "particular direction . . . cannot be predicted". The reason is diffuseness, caused by the wave-character of the X-ray. Consequently, the inability to predict is not due to "the limitations of our present apparatus", but "there is an essential indefiniteness about the event itself". Yet it is difficult to understand just what Compton means by "essential indefiniteness". Does this mean any more than that quantum physics is introducing us to new things-in-themselves, whose *isness* is hidden from us, whose state we cannot determine, but whose activity may approximate accordance with a principle of causality? Would this principle omit or contradict anything that was worth while in the older notion?

I leave this matter as an open question, for the special interest that the philosopher has in the indeterminateness posited in accordance with the newer discoveries in physics is in the possible bearing that this indeterminateness may have on the problem of free will. Here two questions present themselves, the second of which is the only one which we shall consider in detail. The first question is whether, if one could prove real flexibility in the physical world—flexibility that is more than a confession of man's ignorance and implies some positive quality—that flexibility would have any significance for the problem of free will. This point would have to be demonstrated. Of course formerly certain philosophers have admitted a difference between mind and body and yet have maintained that, since the principle of causation obtains in the physical world, it may be regarded as obtaining in the mental world. If one may do that in connection with the principle of causation, it would seem as if one might assume that the only necessary ground for positing flexibility in the mental world is proof that it exists in the physical world. But the justification for assuming causation in the mental world because it was posited in the physical world has not been made clear. Moreover, Bertrand Russell, a confessed neutral monist, has expressed a different attitude on the point.[3] One would think that if any one might say that what is true in the physical world is presumably true in the mental world, a neutral monist might do so, but only a neutral monist. One wonders whether those philosophers who have argued uncritically concerning the application of causation to the mental world will now regard the principle of flexibility as applying to mental phenomena on the basis of its application to

[3] *Cf. Our Knowledge of the External World* 232. Russell does not think that one is justified in assuming causation in the mental world simply because experience has shown uniformity, in some cases, in the physical world.

the physical world. Compton has noted that "those who deny . . . freedom of choice do so primarily because of its conflict with the supposed uniformity of the physical world". Now, he points out, modern physics suggests non-uniformity of action. Indeed, "it is not impossible that choice might alter the statistical distribution of particles in a brain current. Such alteration might well determine the action of the organism and would not violate any fundamental principle of science". This statement makes obvious the fact that Compton is assuming a particular theory of mind without having first established the validity of that theory. Before one can make such an assumption, one must come to grips with the question how much importance conclusions about physical phenomena have for views concerning things mental.

But I leave this question also unanswered to turn to the problem with which this paper is primarily concerned: whether, if one could prove (1) that there is real flexibility in the physical world and (2) that consequently there is flexibility in the mental world, such a conclusion would prove conclusively the existence of freedom. May not flexibility be established as a characteristic of human activity without concluding that therefore man is free in any important sense?

The conception of flexibility in the world is not a new one, and its significance in relation to free will may be most clearly seen by an examination of Bergson's conception of freedom. In the first place, those who reason from the Heisenberg principle of indetermination that there is freedom seem to regard unpredictability, which is a consequence of indeterminateness, as in part the ground for assuming freedom.[4] Such a view is that of the plain man. Now Bergson does deny the possibility of predicting human conduct. The reason he advances is that this assumption does not take account of the true nature of time. It is a mathematical conception of time that leads one to think that the self of the future is the sum of the states preceding it. But real time bites into beings and modifies them. Thus I do not behave as I did yesterday because I change, I endure. If one anticipates what a friend's action will be, one is judging the future in the light of the past or present; one is not really predicting. Our anticipation of the conduct of another is a probable prediction and not an actual prediction based on calculation. Actual prediction is possible only if some antecedent occurs again and again, but that is impossible in the realm of human activity.[5]

[4] An interesting point to note in comparing the view of the advocates of the quantum theory with Bergson's theory is the different significance that discontinuity has for each. From discontinuity in atomic processes—designated as "the very essence of the quantum theory"—the former thinkers infer unpredictability; whereas Bergson implies that the intellect can grasp discontinuity, which exists in the realm of matter, and can predict there, but cannot grasp the continuity of life and therefore cannot predict in the realm of life.

[5] *Cf.* H. Rashdall, *The Theory of Good and Evil* II 303.

It is not, however, on unpredictability that Bergson rests his assumption of freedom, although unpredictability is a consequence of flexibility. For him the free act is indefinable; yet "freedom is the relation of the concrete self to the act which it performs".[6] An act is free that expresses the real self. It is, therefore, because an act originates from the fundamental self that Bergson regards it as free. Furthermore, and this is our special reason for considering his theory, he holds that the free act is characterized by indeterminateness, of which unpredictability is a consequence.[7]

To understand more clearly Bergson's conception of the free act we should note his criticism of both the determinists and the free-willists. The substance of this criticism is that they do not understand the nature of the self or the fact that one creates rather than chooses his future. The plausibility for the deterministic theory rests on a misconception of the self; it is thought of as the sum of its states. Consequently, the assumption is made that each state is conditioned by the preceding states. But this self of the associationistic theory is only the superficial self, the self that is the result of the interaction of the real self with its environment. As for the real or fundamental self, it remains hidden from us for the most part. Its states are not external to one another—as are those of the shadow-self—but interfused. If in a special case one can account for a new state by its antecedent states, one does not necessarily prove that the antecedent states caused the new states, for "our will is capable of willing for willing's sake and then of leaving the act which has been performed to be explained by antecedents of which it has really been the cause".[8] Thus a special relation with the past is read into the act, once it is accomplished.

Since determinists and free-willists have a mechanistic conception of the self, they represent an act of choosing in the following manner: the self is viewed as at a point O hesitating between definitely marked out courses of action OX and OZ. According to the determinists, if the self decides on OX, that is the only path it could take. According to the free-willists, if one decides on OX, he has chosen one of two paths that were equally open to him. He is free because he might have chosen the alternative. The truth of the situation, according to Bergson, is not that there were, in the first place, two definite courses; but that there is a hesitating self which is modified by entertaining the thought of each possibility in turn. The self is different after such deliberation. The course it finally decides on is something that it must create; for the self creates rather than chooses its future. Freedom, then, is "in the shade or quality of action and not in the relation of this act to what is not or to what might have been". Free acts spring from the whole per-

[6] *Time and Free Will* (tr. by Pogson) 219.
[7] *Ibid.* 221.
[8] *Op. cit.* 157.

sonality and express it and "have the same resemblance to it which one sometimes finds between an artist and his work".

Because free acts have this origin, they are very rare. Some people live and die without ever having known freedom. As Bergson states, we often act in an automatic way. Thus, if it is our custom to arise at a certain hour, we do so without the interference of the self. "Even in more serious circumstances, we allow the local process to run its course when our whole personality ought, so to speak, to vibrate." The whole self must enter in to create the future if such creation is to be free.

But one must investigate further to find out in just what light Bergson represents the self that, by virtue of its origination of acts, renders them free. We have already indicated his hostility to the associationistic conception of the self. That superficial self is the self that lives on the surface, determined by ideas and feelings which we do not assimilate. These are imparted by friends or by our education. They "float on the surface like dead leaves". They are those which we have not cherished and so wither in neglect. These ineffectual ideas and feelings limit our freedom. But there are also ideas and feelings which do not limit us. They penetrate to our very nature and change it. Thus "the most authoritative education would not curtail any of our freedom if it only imparted to us ideas and feelings capable of impregnating the whole soul". In other words, the self, if changed by its education, is free when it—now a different self by virtue of the change wrought—originates activity. The ideas and feelings that make it other than it was do not limit its freedom. Only the ideas that have no affect on the fundamental self limit it. The reason is that, in the former case, the self has assimilated those ideas and so, in expressing them expresses itself and is free.

Furthermore, even one idea or one feeling may reflect the whole self.[9] "Feelings, provided they go deep enough, each make up the whole soul since the whole content of the soul is reflected in each of them". Again, "passion, even sudden passion, would no longer bear the stamp of fatality if the whole history of the person were reflected in it".

This self is hardly known to itself; for we ourselves "mostly perceive nothing but the outward display of our mental states. We catch only the impersonal aspect of our feelings, and that aspect which speech has set down. . . . Thus, even in our own individual, individuality escapes us".[10] Consequently the fundamental self is hidden from ourselves. It is also hidden from others. Man bears no organic relation to his fellows. One cannot communicate his inner experiences to others. His attempt to do so—providing he himself knows what those inner experiences are—eventuates in an articulation of conscious states but the very

[9] *Cf. op. cit.* 135, 165, and 167.
[10] *Laughter* (tr. by C. Brereton and F. Rothwell) 153-4.

articulation robs them of their living reality. The requirements of social life are such that we must continue to express ourselves in language; but the self so expressed is merely a shadow. It is this superficial self that is known to others. Such a view of the relation of the self to society makes us wonder why Bergson said that "the France of to-morrow will be what we will it to be, for the future is dependent on us and is that which free human wills make of it". In thus addressing his countryman he does not explain how the fundamental selves—the free selves—of the nation can work together purposefully, since society calls forth only the superficial self and since the free act is the expression of the fundamental self.

From this consideration of the nature of the self that wills free acts, we conclude that it is not limited by outside influences that entirely change it; that it may be expressed in a feeling, a passion, or an idea;[11] that it enters only superficially into relation with other selves; that it is even hidden from itself. This self may inaugurate free acts. It does so when the fundamental self asserts itself, when the real self boils over and breaks the crust that unassimilated ideas form. Then one may decide without any reason or "perhaps even against every reason". Such irrational action, however, expresses the self. Indeed, "the absence of any tangible reason is the more striking the deeper our freedom goes". In short, this boiling over of the real self is the essence of the free act. Here we have a graphic description of the significance of indeterminateness in action that the self inaugurates.

Moreover, Bergson tells us[12] that it is the spontaneity of these acts, their indeterminateness, their newness, their 'upspringing' quality, that characterizes them as free. The consequence of such characteristics—which all go to emphasize the flexibility of the free act—is that the outcome of the free act is unforeseeable. Thus Bergson is partly at one with those holders of the quantum theory who regard flexibility, with its resultant unpredictability, as the essence of freedom. Our problem is whether, if flexibility of acts is established, freedom is proved. And we have presented Bergson's theory because he equates freedom with flexibility. But, as we have noted, he also rests his assumption of freedom on the origination of the act by the self. Consequently we have in his theory two assumptions with regard to the free act: first, it is free by virtue of its origination from the whole self and, second, that it has indeterminateness as an essential characteristic. Is it possible that the second assumption is based in part on an imperfect understanding of the first? I say *in part* because the conception of flexibility in the realm of life is fundamental to Bergson's thought. The question I am raising is whether he would have made the second assumption if he had understood the significance of the first.

[11] *Cf. Time and Free Will* 135, 165, and 167.
[12] *Cf. Creative Evolution* (tr. by Mitchell) 126, 164, 223-4.

Here we turn to a critical estimate of Bergson's theory of the nature of the self. As we have noted, he conceives of two aspects of the self. He does not mean to split up the personality; yet he does talk of the deep-seated and the superficial self. The question arises whether the so-called shadow of the self—which is the result of the reaction of the primary self to its social environment—is not an essential and significant aspect of the self: the self as functioning. It is hard to understand just how he distinguishes between this superficial self, which is *an* outward manifestation of the inner self, and *the* outward manifestation, which is the free act.[13] Furthermore, one gets the impression that the real self goes on developing quite unhampered, for the most part, by any significant contact with its environment. Does not Bergson lack Comte's insight that the self apart from society is an abstraction? Of course, in so far as we accept uncritically conventional points of view, we do live superficially. Can we, in that case, be so optimistic as to assume the existence of a more fundamental self which is living a hidden life? It is hard to understand in what significant way such a self is developing. It seems to be another Topsy who just grows up.[14]

Yet some ideas and feelings do impregnate the whole soul. These change but do not limit the self; only the ineffectual ideas limit the self. Here again Bergson is hard to follow, for one wonders in what sense the terms *ineffectual* and *limit* are used, since those ideas and feelings that "are capable of impregnating the whole soul" do not curtail its freedom.

Again what sort of self is it that may be expressed in a passion, a feeling, or an idea? Also one wonders by what criterion one may distinguish between the feeling that expresses the whole personality and that which usurps it. We are told that if aversion goes deep enough it may do the former, whereas violent anger may usurp the whole personality. In this connection one calls to mind Medea, who was so filled with the desire to wring her husband's heart that she murdered her own children. She was mastered by passion according to her own admission. One remembers how Euripides' Electra brooded over the wrongs done by her mother to Agamemnon and herself until she was almost consumed by her feeling of hatred for Clytaemnestra. Only when her mother was dead did Electra realize the monstrosity of what she had done. One might call to mind other tragic characters who were narrowed to one feeling or one idea so that they lost all sense of proportion. One wonders whether such selves, thus narrowed, could originate any act that might deserve the designation of free.[15]

[13] *Cf. Time and Free Will* 165-6.
[14] *Cf. Creative Evolution* 47-8 and *Time and Free Will* 231.
[15] In connection with Bergson's thought that the self may be reflected in a passion, one is reminded of Santayana's statement that "to throw the whole mind upon something is not so great a feat when the mind has nothing else to throw itself upon. Every animal when goaded becomes intense." *The Life of Reason* IV 88-9.

Is Bosanquet right in assuming with Plato that no important inferences may be made about the self, if its social aspect is neglected? And Bergson thinks of that aspect as hiding the real self. Not only is the real self usually hidden from others but also from itself. If this is so, who is to know that any "boiling over" of an assumed fundamental self is really an expression of that self? It would of course be much more difficult to know that such boiling over is an expression of the *whole* self. Who is to know that "in the simplest state of consciousness the whole soul can be reflected" when that soul's nature is hidden even from itself?

In short, one seems to have in Bergson's self an unknown x, sometimes manifesting itself as a feeling, sometimes as an act of will, a self that is unnecessary to the actual business of developing a life that shall be significant; a self that is a process, a becoming, of unknown origin and of no destination.

As opposed to such a theory we have the view that the self seen from the point of view of psychology has distinguishable aspects; those of thought, feeling, and will; and that yet "no actual moment of life is reducible to any one of these forms taken by itself. Each faculty, on the contrary, represents a logical distinction within the experience of any moment, and the functioning of each penetrates and is penetrated by that of the others. As elements of experience, they do not represent actual states of the mind that are chronologically separable, but aspects of one inner experience that are isolated only through the logical analysis that psychology effects".[16] Furthermore the self is an achievement, that is, a self that deserves recognition as a self in any important sense. In Bosanquet's words, it is "to be made and won, to be held together with pains and labour, not something given to be enjoyed". Moreover, it is organically related to other selves. If this idealistic theory is an adequate statement of the nature of the self, Bergson's conception of it is most unsatisfactory.

One might well agree with Bergson that the free act is inaugurated by the self; but, if the theory just indicated is an adequate one, a person could not follow him in his second assumption that the free act is characterized chiefly by flexibility. If the idealistic theory of the self is correct, one cannot say with Bergson that the free act is "incommensurable with the idea"; that, "though it be the realizing of an intention, it differs as a present and *new* reality, from the intention, which can never aim at anything but recommencing or rearranging the past"; that the free act drops "like an over-ripe fruit", developing, one would gather, without purposive direction.

The consequence of Bergson's theory of freedom resulting from his

[16] J. E. Creighton, "Reason and Feeling", *The Philosophical Review* XXX 468-9.

inadequate conception of the self is best given in his own words. "All that is serious in life comes from our freedom. The feelings we have matured, the passions we have brooded over, the actions we have weighed, decided upon and carried through, in short, all that comes from us and is our very own, these are the things that give life its oft-times dramatic and generally grave aspect".[17] One is not surprised that the feelings, actions, and passions, of a self that is believed to be hampered by reason should be regarded as of a nature that would involve the self in a tragic situation, a situation that can be viewed as comic if we regard ourselves as marionettes. A self uncontrolled by rational purpose is not the whole self. If it is not the whole self, it does not originate free acts—as Bergson would have to agree. It is after all a puppet of passion or of the whim of the moment. This puppet might be characterized as Medea characterizes herself as "overcome of evil . . . ; passion evermastereth sober thought and this is the cause of direst ills to men". If Bergson had followed out his first insight that the free act is initiated by the whole self—of which surely reason is an essential aspect—he might have gone on to represent the self as creating a future that is not darkened by emotional prejudices, passions augmented by brooding over them, and actions unenlightened by reason.

The conception of the self as Bergson develops it, together with his characterization of the freedom he claims for it, leads one to wonder whether that freedom is not the freedom of caprice, which is not real freedom. "The will of the capricious man is one whose motive is to show the bare self as a power in the world. To him it is more important that it is his will and not another's that is realised than that what he wills is realised".[18] In other words, the capricious man is interested in the fulfilment of the act of the will rather than in the act of the will as the expression of any content. Not unlike this man is Bergson's free person who wills "for willing's sake", whose feeling breaks through the crust that is assumed to have been formed over the fundamental self by the advice of his most trustworthy friends. As a result of this "boiling over" the man acts freely from Bergson's point of view.

But in viewing the act of willing thus, Bergson is regarding it abstractly. The act of willing is divorced from the object of willing, and then the will, identified with its capacity to act, is regarded as free because of its indeterminateness. Due consideration, however, will show us that the will so represented is viewed merely under its formal aspect. To separate the *thatness* of willing from its *whatness* or content is to take from the act what makes it concrete and to regard the will abstractly, as it may be thought but never found in experience. An act of will is never without content. When one wills, he wills something; he

[17] *Laughter* 79.
[18] Caird, *The Critical Philosophy of Immanuel Kant* II 270.

does not just will. In so far as one lacks insight into the content of his act of willing, in so far, in other words, as he does not understand what he is willing, one is not free in his willing. That is, in so far as one cannot predict the outcome of his act of willing, he is limited in that act.[19] Moreover, to the extent that there is unreliability in the world, contrary to Compton's postulate, man acts without knowing in how far his intention can be accomplished. In short, in so far as one can prove indeterminateness and its attendant unpredictability in the realm of human action, *that* action is shown to be limited and not free. Only to the extent that the will is enlightened concerning the goal it wills can one postulate freedom of its action.

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ON ALTERNATIVE LOGICS

FROM the fact that there are more than two classes[1] into which all propositions can be grouped, or from the fact that the term 'implies' may have many different meanings,[2] it does not follow[3] that there are or can be a number of exclusive logics. Yet it is on some such suppositions that the whole argument for alternative logics actually rests.

I think that there can be little doubt that both these contentions are correct; that, on the one hand, we can characterize every proposition as being not only true or false, but also as being impossible, probable, etc.; or that, on the other hand, we can combine these propositions in diverse ways and call one of these ways 'implication'. From the recognition of these two truths, we are led on to consider the propositions of logic as having multiple values and to the attempt to exhaust all the possible meanings of the term 'implication',[4] but we cannot make them yield new logics.

[19] *Cf.* Russell, *Our Knowledge of the External World* 234-6, and Dewey, *The Quest for Certainty* 249-50. Substantially this point has been made many times since Hegel's day, but in the light of Bergson's conception of freedom it seems to need further reiteration.

[1] The traditional categories are truth and falsehood, which are called the truth-values of the propositions. Other categories are possible, necessary, etc. *Cf.* Hugh MacColl, *Symbolic Logic and its Applications* 6; C. I. Lewis, *Survey of Symbolic Logic* 292 ff.

[2] See Lewis, *op. cit.* 324 ff.; Paul Weiss, "Relativity in Logic", *Monist*, 1928, 546 f.; "Two-Valued Logic—Another Approach", *Erkenntnis*, 1931, 255 f.

[3] I suspect that the advocates of the doctrine that there are many logics with different laws of deduction will not have the slightest doubt as to what is here meant by saying that 'it doesn't follow', and that they cannot make it follow in any system they might construct. In fact, the very point of this paper is that there is one and only one sense of 'following' that is or could be used in a rational discipline to describe the necessary connection between premiss and conclusion, such that if the premiss be independently asserted, the conclusion may be independently asserted.

[4] In the *Monist*, Oct. 1932, 490 ff., C. I. Lewis presents a few examples of "matrices" dealing with multiple values; in the *Monist*, 1928, 546, I

The error in believing that it follows that there are many logics because there are many truth-values, has its roots in the confusion between an extensional and an intensional approach to logic. When we take the extensional approach we are interested in knowing what can be necessarily concluded from a knowledge of the truth-values of a proposition or set of propositions, without any consideration of the meanings of the propositions. The answer is that if the consequent contains the antecedent as a constituent, and the truth-value of the antecedent as a constituent of its own truth-value (when its own truth-value is expressed disjunctively), then the consequent necessarily follows. This is the answer which is expressed in all the propositions which both two-valued and multiple-valued *systems*[5] of logic assert.[6] From 'this is red' an extensional logician would conclude 'this is red or this is not red'; from 'this is red' as having the truth-value truth, he would conclude 'this is red' as having the truth-value truth or possibility. He cannot conclude 'this is a color' from 'this is red' unless 'this is a color' be understood as a shorthand expression of 'this is red or green or blue, etc.'. Nor can he conclude from the probability that 'this is red' that 'it is probable that this is red', for that would require a tampering with the internal meaning or structure of the proposition.

From the intensional side, our interest in logic is confined to knowing what propositions or concepts have their meanings contained in a given proposition or concept, without considering their truth-values. From 'this is red' we conclude 'this is a color', 'this is darker than pink', 'this is extended', etc.; and from 'it is true that this is red' we conclude 'it is possible that this is red'. As every proposition viewed extensionally has a minimum of meaning (the meaning of its negated as contrasted with its unnegated terms, the meaning of its conjunctions as contrasted with its disjunctions, etc.) every extensional logical proposition can be treated intensionally. Thus, from 'this is red' our extensional approach permits us to conclude 'either this is red or this is not red' because when we disjoin the given proposition from some other that disjunction

showed that there were fourteen possible meanings of implication in a two-valued logic.

[5] For the distinction between systems of logic and logic as apart from system see "The Nature of Systems", *Monist*, 1929, sec. x.

[6] I think that the earliest characterization of a logical proposition as asserting that the antecedent is contained as one of the disjunctive members of the consequent was given in my paper in the *Monist*, 1928, "Relativity in Logic", 546. This relation I then termed "entailment" and distinguished it from 'implication'. I gather from Dr. Blumberg that the distinction between "entailment" and "implication" has been familiar for some time to the members of the Viennese circle though they have not published anything embodying or remarking the distinction. The term "entailment" serves to differentiate this concept from a somewhat analogous but confused notion "entails" introduced by G. E. Moore. See "Entailment and the Future of Logic", p. 145, in *Proceedings, Seventh International Congress of Philosophy*. A more detailed statement of the difference follows below.

necessarily follows from the proposition alone, irrespective of its meaning. But as the meaning of a disjunction always is less and is contained in the meaning of each of the disjoined terms, we can get the same conclusion from an intensional approach. In view of the fact, however, that such a proposition as 'this is darker than pink' cannot be analytically expressed as a disjunction of 'this is red' with some other proposition, it cannot be derived from the latter in an extensional system. Accordingly, an extensional treatment of logic is narrower than an intensional one, of which it is only a special case.[7] There is but one logic connecting antecedents and consequents necessarily, but that necessary connection may be viewed either intensionally or extensionally. All the logics which the advocates of multiple logic have brought forward are systems of extensional logic; though Lewis claims that his system of "strict implication" includes both extensional and intensional propositions and is really neither intensional nor extensional.[8] But the propositions he presents are really extensionally treated, involving multiple values connected by the relation of entailment, and do not refer to the meaning of the propositions involved.[9] Their enunciation does not involve the use of any new principle, and their use does not uncover any new logical law—unless perchance a rule for the production of more truth-values is a new principle and a particular illustration of an entailing relation is a new logical law. Lewis, for example, derives from 'p is consistent with q' the proposition 'p is possible'. He remarks the analogy with 'p and q' but points out that only in the latter case does it follow that 'p is true'. But as 'p is consistent with q' means for him 'both p and q are possible' his proposition 'if p is consistent with q, then p is possible' is nothing but the familiar proposition 'if p and q, then p' where 'p and q' and 'p' and 'q' are given the truth-value 'possible' instead of the conventional 'truth'. We have here not an alternative logic, but the same old logic occupied with a different set of truth-values. Lewis thought his logic was new because in working with it he approached it extensionally and in thinking about it he looked at it intensionally, and discovered that the intensional reading had no place in the extensional systems which he knew. If he only had succeeded in erecting an intensional logic

[7] See the characterization of the relation between intensional and extensional systems in *Proceedings, Seventh International Congress of Philosophy*, 144, 148.

[8] *Survey of Symbolic Logic* 291.

[9] The inadequacy of Lewis' system as a system of intensional logic has been well made out by E. J. Nelson, *Mind*, 1931. Nelson has failed to see, however, that the intensional logic which he himself offered has the characteristic ubiquitous entailment as an essential element, and that thus his system must be of a piece with extensional systems, and that if, furthermore, his system does not include the so-called paradoxical propositions (which are not a bit paradoxical when properly read), his intensional logic is inadequate because it does not cover the intensional side of extensional systems.

which had rules different from those of an extensional logic, there would have been point to his claim, for, as we have remarked before, there are propositions in an intensional logic which could not be brought into an extensional one. But had he succeeded in doing this, he would have discovered not another logic, but the generalized case of which the intensional side of his own and the *Principia Mathematica* was a particular instance.

The second and more significant error lies in the confusion between implication and entailment. G. E. Moore first suggested that there was such a confusion, but in stating it unfortunately himself confused the intensional and extensional meanings of entailment. Alternative definitions of implication are: a disjunction of propositions which is not exhaustive; a relation of two propositions such that the implicans does not have the implicate as a necessary consequence; the conjunction of the implicans and the denial of the implicate is not a contradiction. In a two-valued logic there are fourteen such meanings possible. Of these, four are such that if '*p* implies *q*' be true, and *p* be true, *q* is not false. These four meanings of 'implies' are the result of defining '*p* implies *q*' to mean 'either not *p* or *q*', '*p* and *q*', '*p* is equivalent with *q*' or '*q*'. As the last three cases themselves entail the first, they are not new meanings of implication, but selected cases of it, all of which are extensionally contained in and intensionally contain the first.[10]

The relation of entailment, on the contrary, is a relation between groups of propositions or single propositions such that the antecedent has the consequent as a necessary result. Alternative expressions are: the constituent propositions of an assertion containing an entailment form an exhaustive set; the conjunction of the antecedent with the denial of the consequent is a contradiction; every member of the antecedent expressed disjunctively is contained in the consequent expressed disjunctively. Whether or not they have multiple meanings of implication, differing in all or in part from any of those in a two-valued logic, all extensional systems use the same relation of entailment, and there are no propositions in any of the offered systems which are asserted by their defenders, which do not connect antecedent with consequent by an entailment, in the sense defined. The having many different definitions of implication does not guarantee the possession of many logics. It shows merely that, on the one hand, any combination of propositions can be called an implication-set, and, on the other hand, that there are many kinds of premisses and conclusions which can be necessarily related to one another besides those given in the traditional works. No proposition which the advocates of the multiple theory have produced

[10] Yet Lewis, *Monist*, 1932, 506, speaks of "four implication relations" in two-valued systems, and in his *Mind and the World Order* offers as an *alternative* logic one in which "implies" is taken to mean "equivalent with" and thus is only a part of the *Principia Mathematica* and not other than it.

have been shown to relate its conclusion to its premiss in a unique novel way. And that entailing relation, though obscured by Whitehead, Russell and Lewis by their use of dots as punctuation-marks (as if there were punctuation-marks in logic!) is present in every proposition which they claim to be true. When they have made errors it was because they said that something had the entailing relation when it did not in fact have one.

Lewis,[11] for example, uses '*p* implies *q* is true or doubtful', an abbreviated expression for the following eight disjunctions:

1. *p* true and *q* true
2. *p* true and *q* doubtful
3. *p* doubtful and *q* true
4. *p* doubtful and *q* doubtful
5. *p* doubtful and *q* false
6. *p* false and *q* true
7. *p* false and *q* doubtful
8. *p* false and *q* false

What can follow from '*p* implies *q*' so defined? Besides itself, only itself as disjoined from the one missing alternative: *p* true, *q* false. Neither Lewis nor any advocate of alternative logics has ever maintained that *anything else does or could follow,* or that what does follow is not entailed, in the sense above defined, by what is in the antecedent.

From what can the truth of '*p* implies *q*' follow? As the truth of '*p* implies *q*' is defined as the disjunction of 1, 3, 4, 6, 7, and 8, and as these therefore are contained in '*p* implies *q*', these and these only, or disjunctions of these, can entail '*p* implies *q*'. Neither Lewis nor any other advocate of the position *has ever shown that anything else does or could entail* '*p* implies *q*', as they define '*p* implies *q*'.

From what can the truth or doubtfulness of '*p* implies *q*' follow? Only from the eight propositions or disjunctive combinations of them. *No one has ever revealed a different proposition* (I exclude always the case of contradiction as entailing everything) which could have '*p* implies *q* is true or doubtful' as a necessary consequence, with the given definition of 'implies.'

Consider now proposition 3.11′,[12] which reads that if *p* is possible then *p* is true. Lewis remarks that this proposition is not true in the system he is offering, but that an analogous theorem is true in the *Principia Mathematica;* for by *p* being possible he means 'not *p* implies *p*'. According to his definition of 'not *p* implies *p*', 3.11′ says that 'either not *p* is false and *p* true, or both *p* and not *p* are doubtful'. The first half of this disjunction is equivalent with the truth of *p*, so that the whole says:

[11] Lewis, *Monist,* 1932, p 492.
[12] *Ibid.* 493.

'p is true or both p and not p are doubtful'. Now from a disjunction one cannot necessarily derive one of the members, and so it is quite obvious that the theorem cannot hold. But that does not make the system unique; it shows that it is a good conventional system of the old logical pattern.

There is little point in going through the other propositions. Each of them employs multiple values and defines 'p implies q' in a peculiar way. In the propositions that are asserted what is taken as a consequent is an extensionally entailed consequent; and what does not hold in the system does not hold because the consequent when taken disjunctively does not include the antecedent when taken disjunctively.

There is no need for the believers in multiple logics to invent interesting diagrams or novel symbols in order to demonstrate their point. This method has failed and must fail, for the diagrammatic method involves the use of a two-dimensional space and an extensional treatment, and must obscure the point if there is one. All they need to do is to analyse a *single, valid* logical proposition and show that when they take it extensionally the antecedent is not contained in the consequent, in the sense defined, or that when taken intensionally, the meaning of the antecedent does not contain the meaning of the consequent. Until this is done the whole case for the pragmatic choice of logics, for the untrammeled freedom of the mind, for the infinite logics to be uncovered by the man who can free himself from worldly worries will remain a position stated and not a doctrine proved.

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REVIEWS OF BOOKS

The Nature of Evil. By RADOSLAV A. TSANOFF. New York, The Macmillan Company, 1931. Pp. ix, 447.

There is something profoundly moving in man's attempts to understand his own conduct, something almost paradoxical in the fact that it presents a problem to him. But when he arrives at the question of his standards of conduct and tries to give them a reasonable place in the universe, his efforts are pathetic. The problem of evil seems to arise, says Professor Tsanoff, "from an experienced clash and discord of the actuality with the ideal" (p. 4.). But what in the world, except a naïve self-glorification, ever led human beings to imagine that actuality should accord with the ideal? If one starts with the position that the world is good, obviously the existence of evil is a problem; just as, if one starts with the position that the world is evil, the existence of good is a problem. But why this particular race of animals should dream that its evaluations have a kind of cosmic guarantee is beyond the power of ethicists to explain. There is at least *prima facie* evidence that the cosmos is as indifferent to man as to the lower animals and the vegetables. But the *prima facie* evidence is invariably neglected for the wailings or gloatings of lyrical philosophers which have about as much evidential value as a curse or a hymn.

It is nevertheless true that from the earliest days of recorded thought men have raised the problem of evil and Tsanoff's book is an eloquent record of their ways of solving it. Let it be said at the outset that not only is the record eloquent but well-documented and detailed. Few American philosophers of today have the erudition of its author and few the imagination to see philosophy in poetry as well as in the writings of professors. As an instance of the former, in what other book on the subject would the *Circe* of Gelli appear[1]; of the latter, who of our contemporaries have read and understood the *Cain* of Leconte de Lisle, the *Demon* of Mermontov, and the *Don Juan and Faust* of Grabbe? The book is, moreover, written with the deepest sympathy for the views it expounds and is fair even to pessimism, which is too often in Anglo-American philosophy dismissed as the expression of a psychotic temper.

Tsanoff understands that the denial of good or evil is the denial of a fact and that as soon as man admits of degrees of value, he admits both good and evil. This could, I imagine, be deduced also

[1] Which, as a matter of fact, Tsanoff takes a bit too seriously. The *Circe* was an imitation of Plutarch's Gryllus and was itself one link in a chain of what may be called the "paradoxical" literature of the sixteenth and seventeenth centuries. It was essentially a literary exercise, though of course it had its philosophical implications.

from Brogan's well known thesis, that preference is the root of evaluation and that good and evil must be defined in terms of "better" (p. 389). But he is not content with leaving this as a purely human affair, which would make the problem of evil, as I think R. B. Perry once pointed out, the problem of reducing its amount, but insists at least by implication that human beings could not be produced by a universe which was itself without values. A purely material world, he maintains, could contain neither good nor evil. "Nature", he declares (p. 391), and this would seem obvious, "among its other capacities had and has the making of human nature in it." But does this mean—through a common but perhaps illegitimate use of the dictum *ex nihilo nihil*—that in the infra-human "levels" there are germs of humanity, "potential" values, as animals according to preformationism were folded up in their germs waiting only to be unfolded on the proper occasion? It would seem so from Tsanoff's text. "The lower we perceive the sub-human range of nature to extend, the clearer evidence should we find, in nature's attainment unto personality, of its essentially dynamic, upward reaching character" (p. 391). I have, I admit, but the vaguest idea of what this precisely means, or of how it could be verified if it did mean anything. The whole concept of levels, except as defined in terms of simplicity and complexity, is next to impossible to make much sense out of. When value is defined as something valued and when the appraiser happens to be a human being, it seems at best strange that before there are any appraisers there should be any value. If one were asked to believe that human beings prefer their fellows to the beasts, the generalization would be as acceptable as most generalizations about human tastes. That we prefer the vertebrates to the invertebrates and the animate to the inanimate—with the striking exception of certain minerals—might again be accepted. But this simple empirical principle is not the one at issue. We are asked to believe that there "is a higher and lower in the world", and that this "is not a conclusion of valuation but its prime presupposition" (p. 392). "The first axiom of the philosophy of value is: there is a hierarchy of being, or there is higher and lower in the world, some things are preferable, better, worthier than others" (*Ibid*). This is all very well until we ask, "Preferable to whom; better and worthier for what?"

Granting this Neoplatonic axiom, we find evil to be "literally degradation". "This definition of evil would apply irrespective of the judgment as to what in any specific case is higher or lower, for such difference of judgment would involve a corresponding difference of judgment as to what in the circumstances is evil, and would reaffirm this fundamental conception of the nature of evil" (pp. 392 f.).

Suppose we try to understand this in concrete terms. We are told

(p. 393) that disease is evil in that it destroys biological organization—the "breakdown of highly complex and articulated tissue into tissue cruder or more elementary", etc. Are we to conclude from this—namely that organization is better than disorganization—that oxygen is bad and hydrogen is bad but that when they meet to form water, they turn over a new leaf and become better? Yet I doubt whether there is much actual choice to be made by human beings between water and oxygen. With this and similar queries in mind one reads Tsanoff's almost apocalyptic description of the degeneration of the human organism to dust and ashes through disease with irreverent amusement. And when he passes into aesthetics and announces that "jazz is good music—for savages, but not for the heirs of Bach and Beethoven", one thinks that jazz is also good for dancing and certainly preferred by most mortals on the proper occasions to either Bach or Beethoven, though Bach did write a fairly lively jig or two—the curse of which is removed by calling them "gigues".

The author seems to appreciate this fact when he says (p. 396) that what is natural to the beast may well be a vice in man. "Beastliness is not mere animality; it is degradation of the human to the brutish level, a level natural to the beast but unnatural to man" (*ibid.*). But is the crux of the matter degradation or unnaturalness? If the former, then the beast is in itself more evil than man and beastliness is precisely animality. If the latter, then is it evil for man to try to civilize the savage whose "state of nature" seems to demand an absence of civilization as we know it? There are, according to the last count of Lovejoy, over sixty meanings of "nature" and "natural" and many a good theory has gone blind at the point of seeing a clear meaning in these terms.

Altogether, then, if it is the business of a reviewer to play the judge, this one declares the historical portion of Tsanoff's book unusually enlightening but the theoretical portion somewhat mystifying. But this is perhaps to be expected in view of the subject treated, and as the historical portion is not biased by the theoretical, it is a matter of no great importance in utilizing the book.

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Die Kerngedanken der Platonischen Philosphie. VON CONSTANTIN RITTER. München, Ernst Reinhardt, 1931. Pp. x, 346.

I suppose that the Dialogues do not really contain anything which can be pinned down and ticketed 'Plato's Philosophy'. He wrote no textbooks and expounded no system. But his writings do contain fragments of textbooks and suggestions of systems, together with a depth of insight which has exerted unparalleled stimulation upon all

subsequent philosophers. Just as contact with the mind of Socrates resulted in the construction of the most diverse philosophies, all claiming to be Socratic, so contact with the Dialogues of Plato has always resulted in the most diverse philosophies, all claiming to be Platonic. While the philologist in the ultra-strict sense, who has every idea in the Dialogues duly labeled and tucked away in his museum of antiquities (Fourth Century, B.C.), will always continue to regard the work of such men as Natorp or Windelband or Ritter with official regret and private amazement, it is precisely in this effect upon the modern thinker that the vitality of Platonism consists, and I suppose that Plato himself would regard this vitality as constituting the essence of the philosophy which speaks through his Dialogues to the philosophic intelligence of the twentieth century, no less than to an Aristotle or a Plotinus.

Remembering Ritter's background and previous publications, we should thus expect, in a volume devoted to expounding "the supra-temporal significance of Plato", that he would extract those central thoughts which have exerted the greatest influence upon philosophers, *i.e.*, that he would take the idea of good, the ideal theory, and perhaps the ideals of science and of civic life, and the accounts of the soul and of creation, would loose them gently but firmly from their immediate contexts, and would manipulate them in such a way as to reveal their extra-temporal significance, with especial reference to the twentieth century and its problems. And, in a way, this is what he does, but unevenly.

He discusses the ethical ideas in two separate groups, (1) with reference to the earlier Dialogues, taken one by one, up to and including the *Republic*, and (2) with reference to the later Dialogues, taken all together. What he gives us is mainly a list of the problems discussed and the outlook implied, and it is not until we reach the analysis of the *Lysis* (p. 38), that the author begins to let himself go. He always shows good sense and honesty, and is at times swept along by the greatness of his subject, but on the whole readers of his earlier book will find this part of his work disappointing. The theory of being and theory of knowledge are also discussed in two groups, of earlier and later dialogues, taken, in both groups, dialogue by dialogue. There are, however, occasional summaries and critical comparisons with modern thinkers, especially with Meinong and Husserl. Many modern thinkers will thoroughly approve of the way in which he reads phenomenology out of (or into) Plato. This part of his work is clear, interesting, and thorough.

The remaining chapters deal with Plato's logic, theory of nature, practical philosophy (in the later writings), attitude toward art, and thoughts about God. Of these, the logic seems to be the most

thoroughly done; the treatment of art is the most enlightening; while the other two are little more than (very clear) summaries of the *Laws*, with, however, occasional suggestions that their significance is not confined to Plato's own time. There is a certain amount of direct translation at times, for which, although the passages in question are interesting and important in themselves, the reviewer can see no obvious justification in a work of this kind.

On the whole, there is, perhaps, a real place for such a book as this, in spite of its inequalities of treatment. It will not take the place of Windelband's brilliant little book, or of Natorp's profound study, and the eudaemonist view of Plato's ethics, in spite of the author's (correct) definitions and qualifications, will win few adherents. But the phenomenological treatment of the ideas will be satisfying to many, and the honesty which confesses to inability to systematize the psychological thoughts, and to boredom in reading the *Parmenides*, will awaken sympathetic chuckles in not a few fellow-students.

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Locke, Berkeley, Hume. By C. R. MORRIS, Oxford, At the Clarendon Press, 1931. Pp. 174.

What Dr. S. H. Mellone has attempted to do in *The Dawn of Modern Thought* for the great continental rationalists, C. R. Morris undertakes to do for the three leading exponents of the empirical philosophy. He treats Locke as "more than the founder of a school", and Berkeley and Hume as "more than links in a chain". The chief aim of the study is "to take each of the three in his single character as an individual thinker, and while not obscuring the relation of one to another, to give some account of the unity and balance of the views of each one, taking his philosophy as a whole" (p. 14). As in Mellone's book, a biographical note precedes the philosophical discussion in each case. The literary style does not quite approach that of Mellone in excellence; nor is the content discussed under such copiously outlined topics.

Morris believes that in dealing with these men we are concerned with "the greatest age of British philosophy", notwithstanding the claims of the recent British Idealists under the leadership of F. H. Bradley. He finds that "the Critical aim in philosophy . . . was born with the British empiricists". Locke was the first to see the problem as "the grand problem of the relation of Mind to the Universe". It is "perhaps Locke's chief glory that he first put the right question, and gave to modern philosophy its true orientation" (p. 13).

The familiar doctrines of these philosophers are clearly outlined and their significance noted. The analysis goes somewhat deeply into

the problems; the reader is not simply carried along through an uninspired exposition in the traditional terminology. Relationships among the men are pointed out with precision. The fundamental problems of 'substance' and 'causality' are carefully considered; the scepticism implicit in Locke's doctrine is clearly expounded and is traced through to its culmination in Hume's repudiation of the objectivity of causality. The most interesting and valuable part of this short sketch is probably Morris's presentation of the progress of Berkeley's doctrine from sensationalism to conceptualism. After the treatment of each of the three men, the author attempts, in ten pages comprising the conclusion, to estimate "what is living and what is dead in the thought of the empiricists", that is, what, in this philosophy, has "survived the criticism of Kant".

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Bergson. Par V. JANKÉLÉVITCH. Paris, Félix Alcan, 1931. Pp. VIII, 300.

The author of this book states that his aim is to make Bergsonism comprehensible. How well he accomplishes this in Bergson's own eyes is made evident in a letter from that philosopher himself in which he expresses great interest in and gratitude for M. Jankélévitch's "penetrating study" of his works. He characterizes the study as not only a precise exposition but one that has revealed, with remarkable insight, the development of his thought. One finds that the "precise exposition" is enriched by the comparison of different phases of Bergson's philosophy with the theories of many other philosophers. Thus, for example, the likeness between Bergson's empiricism and that of Berkeley is shown; Bergson's thought is Kantian in its "denunciation of the contamination of mind by externality" (p. 61); a Platonic note is sounded in the Bergsonian postulate that the free act is the "expression of the whole self" (p. 103); the particular theory of the unity of all life approaches Schopenhauer's view; and the critique of finalism is fundamentally in accord with Spinoza's.

Jankélévitch's study maintains the central importance of *la durée* in Bergson's philosophy, rather than of *l'intuition*, as some have thought. And he finds the key of Bergsonism in the criticism of the ideas of *désordre* and *néant*. He shows the development of Bergson's thought; thus, as instances, he shows why intuition is not yet discussed in the *Essai* (p. 64); and he indicates in what form the antitheses, of which the *Essai* offers us a first table, are clothed in *Matière et mémoire*.

But the most striking thing about the book is the inclination characterized, in the letter referred to, as that of making Bergson's

point d'arrivée the author's point of departure for original, personal speculations. Especially is it worth while to note that he does not regard the power of intellect as so limited as does Bergson. Thus, "intellect is not anti-vital except in the measure in which it mixes in plans" (p. 231). That is, intellect obscures its penetration with a ready-made schema. Moreover, of the free act Jankélévitch says that "it has at its source an intentional state" (p. 256). Also, though Bergson says that in the free act we may act without reason, or even against reason, Jankélévitch holds that "one deprives us of our dignity when he says that we decide without reason" (p. 272). And the continuity of the free act with the past is emphasized as an essential characteristic rather than its spontaneity, as with Bergson. As for finality, Bergson's criticism is advanced by Jankélévitch and yet he says that, in the *élan vital*, "sleep all the hopes of the future" and that creative progress has a destination, a mission. (p. 282). Finally, we should note that he holds that a *philosophie spirituelle* is the meeting place of contradictions that are reconciled (p. 210). Thus we find him tending to modify Bergson's sharp distinction between intellect and intuition (pp. 148, 213) and between mind and matter (pp. 243 f.).

MARJORIE S. HARRIS

RANDOLPH-MACON WOMAN'S COLLEGE

An Anthology of Modern Philosophy. Compiled by DANIEL SOMMER ROBINSON. New York, Thomas Y. Crowell Company, 1931. pp. vi, 836.

Professor Robinson's earlier *Anthology of Recent Philosophy* filled so admirably a conspicuous gap in its particular field, that he has been induced to follow it with a companion volume covering the years 1500-1900. Here he is not, unfortunately, the pioneer, and his present effort must warrant its publication by comparison with Rand's *Modern Classical Philosophers*, which covers much the same territory, except that the latter volume includes 125 pages devoted to five recent philosophers: Renouvier, Bradley, Royce, James, and Bergson, who are excluded by the former's deadline at 1900.

A new anthology in a field already occupied must justify itself in one, two, or all of three ways: it must present (1) better selections from the same authors; (2) new material from omitted authors; or (3) superior handling, arrangement, or other editorial apparatus. To take the last of these first, Robinson makes much capital of his introductions, analyses, tables, biographical sketches and questions for discussion, claiming that "these devices will certainly aid readers doing home study or those taking correspondence or extension courses, and I hope that college students may also find them helpful". No one who knows the sophomore's passionate love of formulae will

have any doubt about the latter. But one can only remark that while crutches may be in place in a hospital, they are hardly desirable in collegiate gymnasia. "Helps" have not yet been devised which do not promote laziness in studying, and, what is worse, in teaching also. When a student is given an anthology of this kind, he should be well beyond the go-cart stage of instruction, and so should the instructor.

Of the standard authors Robinson and Rand include substantially the same bulk of material from Hobbes, Descartes, Spinoza, Hume, Comte, Mill, and Spencer. Rand has considerably more of the following: Locke, Berkeley, Kant (110 pages as against 54), Fichte (48 against 27), Schelling, Hegel, Schopenhauer, and Lotze. Robinson's space allotments markedly exceed those of Rand in the cases of Bruno, Bacon, and Leibniz. To weigh the comparative merits of the individual selections from identical authors would require a great many more pages than the Editors have to spare. As for new material, Robinson has included roughly two hundred and thirty pages by fourteen writers who do not appear in Rand. The latter has about thirty pages by one author, Condillac, who does not appear in Robinson. Of the new items included by Robinson, the selections from Bruno and Kierkegaard entire, and part of those from Campanella and Herbart, are nowhere else available in English. Part of the selections from Kant and Hegel, and all of those from Malebranche and Schleiermacher, are from recent translations not previously included in sourcebooks. Other material from Paracelsus, Campanella, and Schlegel is relatively rare. But it cannot be said that any of these rarities are of overwhelming importance to the ordinary college student for whom the book is designed, much less to the patron of correspondence courses. The scholar will be glad to have many of the selections more readily at hand. But it is hard to see where Robinson greatly excels Rand (or better, the Modern Student's series) for use in college courses in the history of modern philosophy. There is fortunately a growing tendency to make such courses either frankly superficial or frankly serious. In the case of the former, Robinson will be likely to be found too bulky; while for the latter, fewer authors in more copious and less "compiled" doses will often be preferred.

For Robinson's editing of some of the classical modern philosophers is open to serious criticism on the score of over-free compilation. In several cases he has run together paragraphs which are widely separated in the original text without indicating the points where the omissions occur. And in the case of Locke, for example, section headings have been supplied which appear to come from the *Essay*, but which are the compiler's own inventions. This style

of improving upon the originals may "help" the innocent beginner, but it leads the careful reader, no matter how unjustly, to distrust the editor in other respects.

This is not to minimize the labor, skill, and capital which have been lavished upon the present volume. That it will be of great value as a work of reference is obvious. But it cannot be said, as in the case of the author's earlier anthology, to stand either alone or sweepingly pre-eminent in its field.

HAROLD A. LARRABEE

UNION COLLEGE

Readings in Ethics. Edited by GORDON H. CLARK and T. V. SMITH. New York, F. S. Crofts and Co., 1931. Pp. x, 401.

This book is not merely a collection of readings, as might be imagined from the title. It is really an introduction to ethics, effected by the study of source-material carefully selected and prefaced by the editors. Each chapter begins with an introduction, in which the editors set forth very concisely, but usually effectively, the social and historical background of each writer, and the outstanding points in his moral philosophy to which the student should give notice in studying the accompanying selections. The successive chapters disclose a logical development of ideas. A reader who mainly agrees with the closing selections (and it is safe to assume that in this case he will agree with the editors) will accordingly finish the book with definite opinions of his own; one who disagrees will at least have thought out the reasons for his dissent. Possibly the beginner may be misled into thinking that in the history of ethics there has been concentration on fewer problems and more logical continuity and consistent development than has actually been the case. However, the editors are probably justified in simplifying the history of ethics for the beginner by concentrating upon a selected group of topics. This is a wiser course than exposing him to a heterogeneous miscellany that would have left him in a state of confusion.

It is on these grounds, I think, that the editors are right in restricting the philosophers considered chiefly to the following: Socrates, Plato, Aristotle, Epicurus, Zeno, Epictetus, Augustine, Aquinas, Hobbes, Butler, Kant, Bentham, J. S. Mill, Henry Sidgwick, G. E. Moore, and John Dewey. To have included other important moral philosophers whose names at once come to mind, like Spinoza, Schopenhauer, Spencer, Nietzsche, and Lévy-Bruhl, would have bewildered the beginner, and would have expanded the volume beyond the limits of an ordinary one-semester college course. The philosophers included are sufficient to afford variety, and yet make it possible to follow threads of development and points of contrast, and to arrive at definite conclusions. The editors are particularly to be congratulated upon their

treatment of Green, Sidgwick, and Moore. By carefully formulated introductions, and by assembling numerous short passages bearing upon each focal point, they have succeeded in making something of the characteristic thought of each of these important but difficult moral philosophers accessible to beginners within the limits of one or two ordinary college class assignments. This is a real achievement.

Dewey is the first and only moralist discussed who has both accepted the theory of evolution and built his ethics upon it (p. 368). In order to avoid misleading the student, more explicit attention (than a passing allusion which I cannot again find; the book has no index) should have been called to the fact that Spencer was actually the first philosopher to realize the ethical importance of Darwinism and to build a system upon it. Subsequent evolutionary moralists owe much to his pioneer work, however greatly they may differ with him on important details.

The volume—fittingly as I think—closes with a selection from Dewey's *Quest for Certainty*, in which the separation of ethical theory from practice is denounced. One is led to infer that on this point, at least, the editors are in sympathy with Dewey's instrumentalism. I hope that this inference is correct. But if it is, I cannot help wondering why the passages selected from each moral philosopher deal almost entirely with the more abstract and theoretical phases of his thought. Are not every philosopher's abstract theories made more intelligible when they are studied in the light of his own applications of them to personal, social, and political problems? Almost every philosopher discussed in the book has left in his writings practical applications of his ethical theories. This is true of Kant and Green, for instance, who in fact were men of like passions with the rest of us. Both were keenly interested in social problems, and were not exclusively the abstract theorists that these selections, taken by themselves, might lead a beginner to suppose.

Taken all in all, however, this is a capital volume. The prefaces are models of clarity, precision, accuracy, conciseness, and suggestiveness. The selections are well chosen, on the whole. The book is interesting and constitutes an admirable introduction to ethics.

WILLIAM KELLEY WRIGHT

DARTMOUTH COLLEGE

Adventures in Philosophy and Religion. By JAMES BISSETT PRATT. New York, The Macmillan Company, 1931. Pp. x, 264.

Doubtless a more effective way to overcome the provincialism of western thought than merely to study its history is to make extended pilgrimages to the east and patiently feel one's way into the very diverse philosophic atmosphere there taken for granted. It is to be

devoutly desired that more European and American thinkers should follow Professor Pratt in such journeys; they give his pronouncements on the great issues of human experience a significant breadth and detachment, and one wonders how else the grotesque onesidedness and pathetic egotism of modern western philosophies is to be really cured.

At the same time the reader of these pages, as of Pratt's earlier works on the same topics, will be apt to wonder whether it is not easy to be content with a too simple combination of eastern and western emphases, to merely polish off into a convenient metaphysical dualism oriental trust in the ultimacy and value of the self and occidental insistence (under the pressure of scientific realism) on the independent reality of the physical world. It may very well be that the experiences underlying a dualistic philosophy must be taken account of more carefully than present tendencies in western thought are apt to acknowledge, but it may also very well be that the dearth of distinctive content in the subjective as such is rightly leading contemporary philosophies in directions which will no longer make a place for dualism in the simple forms hitherto defended.

However, the author offers no positive argument for dualism in the present book. He attempts instead, in dialogue form, a *reductio ad absurdum* of the alternatives to dualism. In the first dialogue (which occupies more than half the volume) Socrates is resurrected from Limbo and made to reveal by his critical questioning the weaknesses in the doctrines advanced by Dr. Idealist, Professor Pragmatist, Professor Neorealist, Mr. Newrealist (G. E. Moore), Mr. Try-Everything-Once (Bertrand Russell), and Dr. Behaviorist. Any follower of contemporary philosophizings who is willing to see his pet opinions played with and at times converted into men of straw to be kicked about rather unceremoniously will find a delightful half-day in store for him, for Pratt does his job very cleverly, with a keen eye for paradox and possible absurdity, and he never hits below the belt. Indeed, he obviously makes a very severe effort not only to reproduce the lingo of opposing philosophies but even to reconstruct the atmosphere of their arguments. Despite this effort, of course no idealist, pragmatist, or realist will be satisfied with the helpless final comments to which Pratt makes Socrates reduce him. This circumstance illustrates the inherent limitation of the dialogue form except when it portrays (as in the greatest of Plato's dialogues and perhaps in Hume's) a genuine inner debate uncommitted in advance to any particular conclusion and willing to grow toward a more adequate point of view by means of the debate itself. Really to appreciate an opposing philosophy it is not enough to talk fairly in its words, though even this is hard to accomplish; it is necessary to move freely by the searchlight of its underlying assumptions and to realize sympathetically

the considerations and motives which make these assumptions seem profoundly reasonable to a vigorous and logical mind. Whether and by what method such appreciation is possible, and how far we may eventually lift philosophy above the level of witty sparring and clever debate are the questions apt to stick more seriously in one's mind after he has followed Pratt's lead through these entertaining dialogues.

Of the discussions which follow the first, the third is of greatest philosophic interest; it culminates in a quite laughable anticipation of the reactions of Dr. Idealist, Professor Materialist, Dr. Behaviorist, etc., on their arrival in the land of personal immortality. The others deal with problems of contemporary religious adjustment. From the standpoint of dramatic art, the second dialogue is perhaps the best in the book.

E. A. Burtt

Cornell University

Proceedings of the Seventh International Congress of Philosophy in 1930. Edited by Gilbert Ryle. Oxford University Press, 1931. Pp. xxxv, 522.

This book contains all of the original papers, eighty-three in number, which were read at the Seventh International Congress of Philosophy, the lists of active and associate members, also the minutes of the meeting of the Permanent International Committee and the minutes of the Business Meeting of the Congress held on September 4. The papers are printed in the language in which they were read.

Although the papers are short and condensed in form, the reader will find here a compendium of the views of some of the world's ablest philosophers on the most pressing issues in the field of philosophy. Various aspects of the problems of logic and epistemology, metaphysics, ethics, esthetics, philosophy of religion, political philosophy, philosophy of history, and philosophy of science, together with reinterpretations of Plato, Aristotle, Descartes, Locke, Kant, J. S. Mill, Royce, and James, are presented. While few if any entirely original views are introduced, the papers as a whole reflect an earnest attempt to deal with old and new problems impartially and in the light of recent knowledge. A strong note of individualism pervades the volume and is apparent both in the wide variety of views offered and the remarkable absence of the restraints of the traditional schools. In this latter feature is indicated a present-day tendency of philosophy to break away from the old molds and to find new forms of expression. As yet philosophy is still using, for the most part, the old vocabulary, but the old terminology is beginning to take on new meaning. Whether philosophy is to take a new step forward by the propounding of new and significant solutions to old problems remains to be seen. Two papers at least boldly make the claim that philosophy is about to enter upon a new era.

Readers interested in the bearing of recent developments in science upon philosophy will turn to the discussions of mechanism, teleology, and vitalism, to Zawirski's defense of determinism, Montague's defense of causality, or to Northrop's resolution of the time-problem in terms of an eternal macroscopic atom enclosing the microscopic atoms. Those with a taste for the problems of logic and epistemology may wish to follow Lossky as he unfolds his intuitionism, Brunschvicg as he relates scientific thought to the ideal of knowledge, or Sellars as he analyzes the "factors of knowledge". Those with an interest in values will read with profit Alexander's distinguishment between truth, goodness, and beauty on the basis of the "controls" at work when these values are created, Croce's sharp attack upon the anti-historical spirit in present-day culture, Lounatcharsky's defense of the Marxian attitude to art, and Müller-Freienfels' proposal of a middle course between philosophical and sociological aesthetics. The distinction between moral rightness and wrongness, as well as the practical utility of ethical and political philosophy, are brilliantly treated. It is unnecessary to add that this volume deserves a place in the libraries of scholars, colleges, and universities.

WALTER S. GAMERTSFELDER

OHIO UNIVERSITY

A World of Epitomizations. By GEORGE PERRIGO CONGER. Princeton, Princeton University Press, 1931. Pp. xiv, 605.

The philosophical study of contemporary science has been expressed in somewhat diverse activities. There are the logical and methodological analyses of contemporary physics by Schlick, Reichenbach, Carnap, Dingler, Broad, Russell. There are the historical studies of Meyerson and Burtt. A third type of philosophical activity, more ambitious than critical and historical studies, has been the attempt at a constructive metaphysics in the light of science. Although it is frequently stated that the growth of specialized knowledge has made comprehensive systems of metaphysics impossible, there have been essays at constructive metaphysics even in the present epistemological and logical era. One may recall the several metaphysical works of Boodin and the more recent treatise of Whitehead. The subject of the present review is a notable contribution to scientifically grounded metaphysics.

The thesis of the author is that the universe is a vast system of systems which strikingly resemble one another in the details of their structures and processes. In the first division of the book he analyzes the relational structure of the systems, or realms, of matter, life, and mind. His hypothesis is that the structures and processes of matter, the cosmogonic realm, resemble those of life, the biotic realm, and

both matter and life resemble mind, the neuropsychological realm. In each realm there are levels, which in turn are subdivided into sublevels. The structures characteristic of each of these levels are called monads. Epitomization by analogy is the hypothesis that the monads of the various levels and realms exhibit significant resemblances in their characteristic structures and processes. Epitomization by parallelism is the hypothesis that monads of the various levels and realms may be arranged in parallel columns and studied in the light of their resemblances. For example, there is parallelism between clusters of clusters of spiral nebulae, racial or continental societies, and selves.

The theory is expounded with the aid of an intricate system of decimal notation which is modeled on, but goes beyond, the system of *Principia Mathematica*. Thus numbers with as many as nine digits are required to indicate the proper position of a structure within its realm and level. The data of the natural and social sciences are expounded so as to exhibit their precise position in the carefully articulated structure.

I have been profoundly impressed by the author's mastery of a great wealth of scientific material. In so far as I am able to judge, he uses the scientific data competently and objectively. The compact discussion of the theory of relativity is especially admirable. In the face of this brilliant constructive achievement I am loath to criticize, but I do think, however, that it would have been preferable to omit references to the contemporary theories of Sir Oliver Lodge and of others whose views are without influence upon the present development of physics.

In division two of the book the hypothesis of epitomization is extended to the prior subsistent realms of logic, number, and geometry —kinematics. It is argued, for example, that the relationship of term to proposition is parallel to that of the atomic nucleus to its peripheral electrons, or the cell nucleus to its cytoplasm. The syllogism is compared to an act of fertilization; the conclusion of a syllogism to a fertilized egg; implication to heredity. Aside from such comparisons, however, this division contains many original discussions of logical topics. The reviewer found the theory of possibility and the original interpretation of the postulates of *Principia Mathematica* and of C. I. Lewis especially interesting.

The book is a very great contribution to systematic metaphysics and to the philosophy of science. In extent of employment of detailed scientific material it is unique; the analyses are careful, competent, and objective. But above all it is characterized by an originality of analysis and synthesis which is sustained with remarkable power throughout its six hundred compact pages.

V. F. Lenzen

University of California

DESCRIPTIVE NOTICES

Aristotle on the Art of Poetry. An analytic Commentary and Notes by A. S. Owen. Being a Companion to the Translation by Ingram Bywater. Oxford, At the Clarendon Press, 1931. Pp. 82.

This booklet is intended as a help for pupils, mostly Greekless, in passing examinations (p. 3). "Usually Bywater's views have been adopted; but in a few passages, e.g. in Chapter 4, those of other editors have been accepted." On that chapter, Owen by "art" means painting, which, to use his own words about Aristotle, "suggests a very limited conception of it". Like many another, he rises superior to Aristotle, when the chances are a million to one that the elder was the abler man. The comment is not well-written; witness the ugly compound "plot-construction" (p. 16), where "construction" would suffice. Some interesting, here and there illuminating, examples are supplied from the works of Shakespeare, Dickens, and Browning; but "unsafe", "beefsteak", "Nonconformist", and "restaurant" hardly illustrate Aristotle's views (p. 41) of "what words are suitable for poetry". On page 34 it is said that "we do not know how" the fifth form of Discovery "was worked"; Keble College evidently has something to learn from an article on the subject by J. A. Smith of Magdalen in the *Classical Quarterly* for 1924, or from mine in the *American Journal of Philology* for 1918 (revised in *An Aristotelian Theory of Comedy*, 1922), or from Philippart's in the *Revue des études grecques* for 1925. On page 37 there is a bad conflation of two ideas that are distinct in the *Poetics* of Aristotle, namely, how much material may be included in a poem, and what sort of stories will evoke, not pity and fear, but "the human feeling" in us; the consequent misapplication of Agathon's utterance on probability is the worst thing I have found in the comment. The Notes (pp. 54-82) are more useful. The level of the whole falls below what we expect from the University of Bywater, Smith, and Ross.

Lane Cooper

Cornell University

Art and Beauty, By Max Schoen. New York, The Macmillan Co., 1932. Pp. 230.

This book has an introductory chapter on "The Nature and Objective of Aesthetics" in which the author contends that a definition of beauty and art is both possible and valuable, and that it is the task of aesthetics to discover it. The book is divided into two parts, dealing with art respectively from the standpoint of the creative artist and of the appreciative layman. Numerous documents are quoted at length, to provide the material for an inductive approach to the problems raised. The author's powers of analysis and synthesis, however, are hardly adequate to the digestion of that mass of material, and his conclusions are accordingly for the most part lacking in definiteness and penetration. While the book is on the whole interesting enough to be worth reading, it is hardly an important contribution to the subject it deals with.

C. J. Ducasse

Brown University

The Revolt of the Masses. By José Ortega y Gasset. New York, W. W. Norton and Company, 1932. Pp. 204.

This book presents two theses: first, the social scene is now dominated by the masses, that is, by the large number of mediocre persons for whom life has been made easy by liberal democracy and modern technology, who take civilization for granted and feel no obligation for its maintenance or advance, and who are self-satisfied, undisciplined, and indocile. Second, the building up of Europe into a great national state which shall fuse existing nationalities is the only solution of the political and economic ills that beset western Europe and the only means of restoring European rule over the rest of the world and of counterbalancing a possible success of communism. The second thesis is presented with genuine moral enthusiasm; indeed, it is united to the first, somewhat tenuously, by the faith that such an ideal might restore the leadership of an intellectual and moral aristocracy. In method and in style the book belongs to the class of prophetic and intuitive literature. Accordingly it abounds in large generalizations that are unverifiable and vague phrases that are asserted to be realities but are in fact nearly meaningless to the uninitiated. It reminds one a little of Spengler, except that the conclusions are quite different; the author feels certain that liberal democracy is the highest type of public life and that every European "knows" it, that Fascism and communism are quite out of the line of European progress, and that the capacity for fusion in European nationality is unlimited. In its underlying philosophy the book sometimes suggests Bergson and sometimes Hegel.

George H. Sabine

Cornell University

Values: A Philosophy of Human Needs. By Milton Sills and Ernest S. Holmes. Chicago, University of Chicago Press, 1932. Pp. 136.

Philosophy herewith adds a movie hero to her *dramatis personae.* Milton Sills, of cinema fame, conversed with Ernest Holmes (for stenographic record) on Reality, the Creator, Values, Personality, and Faith. Mr. Sills identifies Being with Becoming, God with Reality, and maintains that Truth is not absolute but instrumental. Emergent evolution, he believes, makes probable "unborn laws which unborn human consciousness will discover at a future time", but such consciousness does not emerge from the wholly unconscious, and he anticipates that a law of Spiritual Faith is yet to emerge more fully. Various passages in these dialogues may be tagged mystic, humanistic, pragmatic, but on the whole Mr. Sills seems to have a philosophy of his own. With more leisure and a longer life he might have developed it significantly. As it is, this much too short and stilted record renews interest in conversation between others than strictly academic philosophers as a medium for philosophic advance.

Eleanor Bisbee

University of Cincinnati

Recherches philosophiques. Publiées par A. Koyré, H. Ch. Puech, A. Spaier. Paris, Boivin & C^ie^, 1931-1932. Pp. viii; 518.

Patronized by the leading philosophical scholars of France, this first volume of a new annual periodical gives one a compendious summary of

the researches that have been shaping French philosophy for the last year (1931-1932). Beside articles (which are often first chapters of forthcoming works) by J. Wahl, A. Spaier, G. Bachelard, Heidegger, Laird, etc., three hundred and forty-five recent volumes and articles are analyzed. Thus the periodical should serve those who are doing research work in any branch of philosophy, especially in the history of philosophy and in the contemporary period. The article of R. Johan on *La raison et l'irrationnel chez M. Meyerson,* for example, not only furnishes a clear, precise, and well written synthesis of all the works of M. Emile Meyerson, but also concludes with a profound critical inquiry concerning the absolute irrationality of the real. Apart from Laird's discussion of the Oxford moralists, the German researches in the philosophy of mathematics and psychology receive the greater part of the space given to foreign movements.

PHILIP PAUL WIENER

COLLEGE OF THE CITY OF NEW YORK

Logik des Widerspruchs. Von ROBERT HEISS. Berlin, Walter deGruyter & Co., 1932. Pp. viii, 130.

This study bears the sub-title, "Eine Untersuchung zur Methode der Philosophie und zur Gültigkeit der formalen Logik". It presents a two-fold thesis: (1) formal logic fails to do justice to contradictions and antinomies and (2) these "forms of thought" involve essentially the "Selbstanwendung" of concepts and judgments (*e.g.,* the doubting of doubting, "I am lying", etc.). The need for a special logic of "Selbstanwendung" is deduced and in part supplied. The author first points out the basic rôle of contradictions in the philosophical methodologies of Husserl, Descartes, Kant, and Hegel. He then proceeds in more than sufficient detail to develop the second part of his thesis. Although he mentions the contradictions which gave rise to the theory of types, he nowhere undertakes to establish the legitimacy of "Selbstanwendung" by a critique of that theory.

ALBERT E. BLUMBERG

THE JOHNS HOPKINS UNIVERSITY

Philosophers in Hades. By T. V. SMITH. Chicago, The University of Chicago Press, 1932. Pp. xvi, 230.

This is a rollicking dialogue between an Earthling (Professor of Philosophy in the University of Chicago until killed in an airplane crash) and the shades of the Greek philosophers. He chats familiarly with Socrates, Zeno, Thales, and other Hades-dwellers about their history and hobbies; they interpret their views and correct much current misinformation. Plato visits Hades from Elysium, Heraclitus rises from Hell, and two professors are brought by Pluto from Chicago to relieve the Earthling's nostalgia. Fifteen interviews provide the reader both entertainment and instruction, for beneath much clever jesting the author states the philosophy of each character in the dialogue, including his own.

GEORGIA HARKNESS

ELMIRA COLLEGE

The Wisdom of Confucius. A Collection of the Ethical Sayings of Confucius and of His Disciples. Edited by MILES MENANDER DAWSON. Boston, International Pocket Library, 1932. Pp. 64.

This is a collection of utterances from the Confucian literature (The Five Classics and The Four Books), arranged topically under such headings as "The Superior Man", "The Art of Living", "Mental Morality", "Learning", "Genius and Inspiration", "Sincerity", through thirty-three topics. It is a manual for the devotee of Confucianism, offering material to meditate upon in the spirit of that school. It makes no distinction between the traditions supposedly edited by the Master, the thoughts received from his own lips, and the commentaries of Mencius, formulated after the manner of the Master. It offers a systematic summary, not concerned with historical development.

A. E. AVEY

THE OHIO STATE UNIVERSITY

Mencius. Translated by LEONARD A. LYALL. New York, Longmans, Green and Co., 1932. Pp. xxviii, 278.

This book presents a new translation of the last of the Four Books of Confucian literature, consisting of the meditations after the manner of the Analects, with annotations, a detailed index of Subjects, and an index of Names. It brings to the English reader in a convenient form the works of the greatest of the followers of Confucius. The thoughts of Mencius are usually submerged beneath those attributed to his master. They are here set forth by themselves in a form which gives them better opportunity for consideration in their own right. Like the rest of The Four Books they are brief glimpses of the discussions of the school on ethical questions.

A. E. AVEY

THE OHIO STATE UNIVERSITY

Neo-Hinduism. By D. V. ATHALYE. Bombay, D. B. Taraporevala Sons & Co., 1932. Pp. 226.

This is an account of the life and doctrines of the Swami Vivekananda, patriot saint of modern India, (1863 to 1902). His lifework was to revive Vedic Hinduism, the religion of the Upanishads, and also to preserve and solidify the significant additions made to it. These developments are to be found in four chief schools of thought, Bhaktiyoga (discipline of devotion), Jnanayoga (discipline of understanding), Karmayoga (discipline of action), and Rajayoga (discipline of spirit), each of which, after a chapter on Hinduism in general, receives a special exposition. The doctrine regards all religions and philosophical systems as aspects of truth. It aims to set up a spiritual ideal to guide social reform; and sees in India the spiritual leader of the world.

A. E. AVEY

THE OHIO STATE UNIVERSITY

Blessed Spinoza. A Biography of the Philosopher. By LEWIS BROWNE. New York, The Macmillan Company, 1932. Pp. xviii, 334.

As the title indicates, this is a biography of Spinoza, not an account of his philosophy. There are occasional (and not always happy) references

to his philosophical position; but these are only incidental and not integral to the story. Since what is actually known about Spinoza's life may be told in little space, an account the length of this one must be built of considerable padding. Despite its padding, however, the story here is well told and is essentially accurate. The book is provided with a short selected bibliography.

G. WATTS CUNNINGHAM

CORNELL UNIVERSITY

Histoire de la philosophie. Tome II. La philosophie moderne: 3 et 4. Le xix^e^ siècle. Par ÉMILE BRÉHIER. Paris, Félix Alcan, 1932. Pp. 572-1184.

These two parts bring to its completion the author's general history of philosophy. Parts 1 and 2 of this volume are devoted to the seventeenth and eighteenth centuries respectively. The twentieth century is briefly touched in part 4, which also includes a general Index. The first volume is composed of three parts as follows: Part 1, The Hellenistic Period; Part 2, The Hellenistic and Roman Period; Part 3, The Middle Age and the Renaissance. The several parts of each volume are available separately.

G. WATTS CUNNINGHAM

CORNELL UNIVERSITY

The Mind in Action. By A. CAMPBELL GARNETT. Cambridge, University Press; New York, D. Appleton and Company, 1932. Pp. xii, 226.

Garnett's book is written in the English temper, as are most of the other volumes in the Contemporary Library of Psychology, a series which hopefully promises a "comprehensive view of the whole field". Readers of Ward, Stout, McDougall, and Spearman will recognize the doctrinal ring of the book, which is chiefly about cognitions and conations. Especial emphasis is laid upon those conations where the self enters and seeks its valued ends. The self, a finite center of experience, attempts cognitively and conatively "to penetrate the reality in which it dwells" (223). Hence truth, beauty, morals, and religion. To many British students this is of the essence of psychology. If not quite an arm-chair exposition, we can safely catalogue it among the doctrines of the writing-arm-chair into which the description of concrete facts seldom enters.

MADISON BENTLEY

CORNELL UNIVERSITY

Hegel, nel centenario della sua morte. Pubblicazione a cura della Facoltà di Filosofia dell' Università Cattolica del Sacro Cuore. Milano, Società Editrice "Vita e Pensiero", 1932. Pp. xv, 395.

In this Neo-Scholastic symposium, an international company of scholars undertake, in ten essays, a survey of Hegel's spreading influence on modern thought, an analysis of Hegelian ideas in Italian, French, German, British, American, and Russian philosophy, and a critical interpretation of Hegelianism. Allowing for certain inevitable differences in method of treatment and in distribution of emphasis, the volume is an impressive appraisal of Hegelian idealism by respectful but resolute opponents. The initial essay, by the Rector of the Catholic University of Sacro Cuore, Fr. Agostino

Gemelli, is meant to set the tone of the book. Hegel's rejection of the Transcendent, that is, of God, makes his philosophy the most radical negation of Christianity. Atheism is here revived in pantheistic guise; the exaltation of Becoming, human self-apotheosis, self-confident dialectic, ethical relativism, pagan-protestant worship of the state, of actual power, *statolatria:* in all these, Hegelianism is disclosed as a ruinous menace to the eternal and saving Christian verities. The essays reveal the vigorous tactics of contemporary Thomism, and should prove of interest even to those for whom Hegel is not as vulnerable, or else not as important, as he is made to appear in this volume.

RADOSLAV A. TSANOFF

THE RICE INSTITUTE

Asiatic Mythology. By J. HACKIN and others. New York, Thomas Y. Crowell Company, 1932. Pp. 460.

This is an English rendering of a work published originally in French by eight specialists in oriental mythology, all connected with the Musée Guimet of Paris. It is a popular account of the most influential figures in the religious traditions of the East. Fifteen colored plates and over three hundred and fifty other illustrations make the book incomparable from the standpoint of pictorial representation of its themes.

E. A. BURTT

CORNELL UNIVERSITY

Die Philosophie des Als Ob und das Leben. Von A. Seidel und anderen. Berlin, V. Reuther & Reichard, 1932. Pp. vii, 248.

A group of essays written by students and followers of Hans Vaihinger in honor of their teacher on the occasion of his eightieth birthday. The foreword announces the formation of a Vaihinger-Gesellschaft which, commencing with the present year, is to add another to the list of German philosophical journals.

E. A. BURTT

CORNELL UNIVERSITY

The Absurdity of any Mind-body Relation. By CHARLES S. MYERS. London, Oxford University Press, 1932. Pp. 28.

This is No. 2 of the Hobhouse Memorial Trust Lectures, delivered in 1932 at University College, London. The author argues that organisms, and indeed the universe itself, exhibit non-mechanical directive activities associated with mechanical processes, and this directive activity is synonymous with mind. Since mind and life are identical properties of living matter, there is no mind-body relation.

GEORGE H. SABINE

CORNELL UNIVERSITY

Regulae ad directionem ingenii. Regles pour la direction de l'esprit. Par RENE DESCARTES. Texte revu et traduit par GEORGES LE ROY. Paris, Boivin et C^ie^, 1932. Pp. xxii, 224.

The Latin text has been newly constituted by collating the first published edition with a manuscript of Hanover, formerly the property of Leibniz.

The variations from the text of Adam and Tannery are neither numerous nor important. The editor has supplied an *apparatus*, a parallel French translation, and a brief introduction.

GEORGE H. SABINE
CORNELL UNIVERSITY

The following books were received during the months of June and July.

Collected Papers of Charles Sanders Peirce. Edited by CHARLES HARTSHORNE and PAUL WEISS. Volume III. Exact Logic. Cambridge, Harvard University Press, 1933. Pp. xiv, 434.

Foundations of the Philosophy of Value. An Examination of Value and Value Theories. By H. OSBORNE. Cambridge, The University Press; New York, The Macmillan Company, 1933. Pp. xxii, 132.

The Meaning of Right and Wrong. By RICHARD C. CABOT. New York, The Macmillan Company, 1933. Pp. xii, 464.

Goethe Centenary Papers. Edited by MARTIN SCHÜTZE. Chicago, The Open Court Publishing Company, 1933. Pp. viii, 174.

Law and the Social Order. Essays in Legal Philosophy. By MORRIS R. COHEN. New York, Harcourt, Brace and Company, 1933. Pp. xii, 404.

Academic Illusions. By MARTIN SCHÜTZE. Chicago, The University of Chicago Press, 1933. Pp. xiv, 328.

How We Think. A Restatement of the Relation of Reflective Thinking to the Educative Process. New Edition. By JOHN DEWEY. Boston, D. C. Heath & Company, 1933. Pp. x, 302.

The Great Enigma. A New View on the Outlook of Life. By HUGO HERMANN SCHAUINSLAND. Translated from the German by Walter H. Schauinsland. New York, E. P. Dutton & Co., 1933. Pp. 94.

Authority and Reason in the Middle Ages. The Hulsean Lectures, 1931-32, University of Cambridge. By A. J. MACDONALD. London, Oxford University Press, 1933. Pp. viii, 136.

The Living Universe. By SIR FRANCIS YOUNGHUSBAND. New York, E. P. Dutton & Co., 1933. Pp. x, 254.

Philosophy of Hindu Sadhana. By NALINI KANTA BRAHMA. With a Foreword by SIR SARVAPALLI RADHAKRISHNAN. London, Kegan Paul, Trench, Trubner & Co., 1932. Pp. xvi, 334.

L'expression de la vie dans l'art. Par CHARLES LALO. Paris, Félix Alcan, 1933. Pp. 264.

Mathématique et philosophie. Par R. WAVRE. Bruxelles, Maurice Lamertin, 1933. Pp. 16.

La jeunesse d'Auguste Comte et la formation du positivisme. I. Sous le signe de la liberté. Par HENRI GOUHIER. Paris, J. Vrin, 1933. Pp. 316.

Histoire de la biologie végétale en France. Par RAOUL COMBES. Paris, Félix Alcan, 1933. Pp. 172.

Précis d'une sociologie. Par O. LEMARIÉ. Paris, Félix Alcan, 1933. Pp. viii, 192.

La mauvaise conscience. Par VLADIMIR JANKÉLÉVITCH. Paris, Félix Alcan, 1933. Pp. 162.

Le Dieu de Bergson. Par EMILE RIDEAU. Paris, Félix Alcan, 1933. Pp. 142.

Les rapports de la matière et de l'esprit dans le Bergsonisme. Par ÉMILE RIDEAU. Paris, Félix Alcan, 1933. Pp. xii, 358.

L'Odyssée de la conscience dans la dernière philosophie de Schelling. Par VLADIMIR JANKÉLÉVITCH. Paris, Félix Alcan, 1933. Pp. 358.

Les fondements du droit. Par EMMANUEL LÉVY. Paris, Félix Alcan, 1933. Pp. 170.

Les aubes de l'humanité. Par LOUIS HOYACK. Paris, Marcel Rivière, 1933. Pp. 268.

Félix Ravaisson: Testament philosophique et fragments. Texte revu et présenté par Charles Devivaise. Paris, Boivin et C^ie^, 1933. Pp. viii, 200.

La psychologie Bergsonienne. Étude critique. Par ROGER-E. LACOMBE. Paris, Félix Alcan, 1933. Pp. 326.

Les sources et les courants de la philosophie contemporaine en France. Par J. BENRUBI. Tomes I et II. Paris, Félix Alcan. Pp. viii, 1058.

Das Ethos und die Idee des Erkennens. (Philosophie und Geschichte 44). Von HERMAN SCHMALENBACH. Tübingen, J. C. B. Mohr, 1933. Pp. 32.

Die seelische Eingliederung in die Gesellschaft. Von WILHELM STEINBERG. München, Ernest Reinhardt, 1933. Pp. 128.

Spinoza-Festschrift. Herausgegeben von Siegfried Hessing. Heidelberg, Carl Winter, 1933. Pp. xvi, 224.

Das Problem der Gleichzeitigkeit. Von KARL VOGTHERR. München, Ernst Reinhardt, 1933. Pp. 200.

Die Psychologie der einzelnen Künste. III. Bd. Von RICHARD MÜLLER-FREIENFELS. München, Ernst Reinhardt, 1933. Pp. 179-336.

Hegel und das zwanzigste Jahrhundert. Von ERNST HARMS. Heidelberg, Carl Winter, 1933. Pp. 42.

Die Seele des Menschen. Versuch einer verstehenden Psychologie. Von ALEXANDER PFÄNDER. Halle, Max Niemeyer, 1933. Pp. vii, 416.

Gedanken zur Naturlehre. Von HERRMANN BURG. Bern-Berlin, Hans Huber, 1933. Pp. 72.

Die psychophysiologisch nachweisbare Grenze des Menschenverstandes. Von CARL KRISMAYR. Wien, Wilhelm Braumüller, 1933. Pp. 152.

Die Seelische Eingliederung in die Gesellschaft. Von WILHELM STEINBERG. München, Ernst Reinhardt, 1933. Pp. 126.

Neo-scolastica idealismo e spiritualismo. Per FRANCESCO OLGIATI e ARMANDO CARLINI. Milano, Societa Editrice "Vita e Pensiero", 1933. Pp. viii, 180.

Het Calvinisme en de Reformatie van de Wijsbegeerte. Door D. H. TH. VOLLENHOVEN. Amsterdam, H. J. Paris, 1933. Pp. 320.

NOTES

Dr. Felix Adler died on April 24, 1933, in his eighty-second year. He received his A.B. degree from Columbia University in 1870 and his Ph.D. degree from Heidelberg in 1873. He was Professor of Hebrew and Oriental Literature in Cornell University, 1874-76. In 1876 he founded the New York Society for Ethical Culture and became Professor of Political and Social Ethics in Columbia University in 1902. He was Roosevelt Exchange Professor at the University of Berlin, 1908-09; Hibbert Lecturer at Oxford University, 1923; President of the Eastern Division of the American Philosophical Association, 1928. He was one of the founders and a member of the editorial board of the *International Journal of Ethics*. Among his works are the following: *Creed and Deed*, 1877; *The Ethics of the Political Situation*, 1884; *The Moral Instruction of Children*, 1892; *Marriage and Divorce*, 1905; *Religion of Duty*, 1905; *Essentials of Spirituality*, 1905; *The World Crisis and Its Meaning*, 1915; *An Ethical Philosophy of Life*, 1918; *The Reconstruction of the Spiritual Ideal* (Hibbert Lectures), 1923.

Professor Roger Bruce Cash Johnson, Chairman of the Department of Philosophy of Princeton University, has been appointed McCosh Professor of Philosophy at Princeton.

Professor Charles M. Bakewell of Yale University retired from active service in June, 1933.

Professor Charner M. Perry, formerly of the University of Texas, has been appointed assistant professor of philosophy at the University of Chicago. He will also act as Associate Editor of the *International Journal of Ethics*.

The Editors of the PHILOSOPHICAL REVIEW are pleased to publish the following announcement at the request of the American Council of Learned Societies:

The American Council of Learned Societies offers in 1934 grants in aid of research and post-doctoral fellowships for training and research in the humanities. The grants are in two categories: small grants, not exceeding $300, and larger grants, not exceeding $1,000. Applicants for grants must possess the doctorate or its equivalent, and must be actually in need of the desired assistance and unable to secure it from other sources. The grants are made for specific purposes (other than living expenses or in lieu of salary), such as travel, photostats, secretarial assistance, etc., in connection with projects of research actually under way.

The fellowships have a basic stipend of $1,800, to which allowances for travel, expenses of research, and other purposes may be added. Applicants must have the doctorate, must not be more than 35 years of age, and must have demonstrated unmistakable aptitude for constructive research.

Information respecting grants and fellowships, as well as application blanks, may be secured from the American Council of Learned Societies, 907 Fifteenth Street, Washington, D.C. All applications must be filed by December 15, 1933, and awards will be announced in March, 1934.

The following is a list of articles in current philosophical periodicals:

THE MONIST, XLIII, 2: *Karl Schmidt,* The Existential Status of Facts and Laws in Physics; *Donald C. Williams,* The A Priori Argument for Subjectivism; *Everett W. Hall,* Focalized Identity; *D. M. Datta,* The Objective Idealism of Berkeley; *Seba Eldridge,* Specialization and Integration in Intellectual Inquiry; *Bruce W. Brotherston,* The Primitive Mental Attitude and the Objective Method in the Study of Mind; *Everett J. Nelson,* On Three Logical Principles in Intension; *A. Ushenko,* The Problem of General Propositions.

THE JOURNAL OF PHILOSOPHY, XXX, 10: *D. W. Gotshalk,* The *A Priori*; *W. H. Roberts,* The Fallacy of Unipolar Explanation. 11: *V. F. Lenzen,* Indeterminism and the Concept of Physical Reality; *Paul Weiss,* The Metaphysical and the Logical Individual; *Kurt Edward Rosinger,* Material Truth in Rational Thinking. 12: *Evander Bradley McGilvary,* Perceptual and Memory Perspectives. 13: *Gustav Mueller,* Concerning Platonic Esthetics; *Arnold H. Kamiat,* The Problem of Knowledge; *Arthur E. Murphy,* A Rejoinder. 14: *Ernest Nagel,* Charles Peirce's Guesses at the Riddle.

THE INTERNATIONAL JOURNAL OF ETHICS, XLIII, 4: *A Fiscus Liber and David Weinman,* Standardization and Ethics; *Arnold H. Kamiat,* Toward a Philosophy of Democracy; *Robert Withington, Religio Duorum Medicorum; Gustav Mueller,* Another Approach to Socrates; *Theodore T. Lafferty,* A Scandal in Philosophy, or How to Make Philosophy Interesting.

THE SYMPOSIUM, IV, 3: *Dwight MacDonald,* Notes on Hollywood Directors (11); *Bernard Raymund,* Homestead; *Henry Bamford Parkes,* Jeffersonian Democracy; *Paul Goodman,* The Wandering Boys; *Myra Marina,* To One Dedicated; *Hi Simons,* The Etiology of the Wordsworth Case.

THE NEW SCHOLASTICISM, VII, 3: *U. A. Hauber,* The Mechanistic Conception of Life; *S. Harrison Thomson,* The *De Anima* of Robert Grosseteste; *Thomas Verner Moore,* The Scholastic Theory of Perception.

THE AUSTRALASIAN JOURNAL OF PSYCHOLOGY AND PHILOSOPHY, XI, 2: *W. A. Merrylees,* Judgment; *W. R. Boyce Gibson,* What is Philosophy? *Rona Blogg,* About the Art of Painting; *A. Nechaev,* Psychology and Radio (II); *W. G. Slade,* Earthquake Psychology (II); *D. Brown,* The Principle of Uncertainty; *J. L. McDermott,* The Problem of the Unruly Child; *H. B. Loughnan,* Scholasticism versus Realism in Ethics.

THE BRITISH JOURNAL OF PSYCHOLOGY, XXIV, 1: *L. S. Penrose,* A Study in the Inheritance of Intelligence; *R. B. Cattell,* Temperament Tests. II. Tests; *R. W. Pickford,* The Tendency towards Synthesis in Reading; *J. W. Cox,* Some Experiments on Formal Training in the Acquisition of Skill; *H. T. H. Piaggio,* Three Sets of Conditions necessary for the Existence of a 'g' that is Real and Unique except in Sign; *C. Spearman,* The Uniqueness and Exactness of 'g'; *E. Farmer,* The Reliability of the Criteria used for Assessing the Value of Vocational Tests.

THE AMERICAN JOURNAL OF PSYCHOLOGY, XLV, 3: *H. Woodrow,* Weight-Discrimination with a Varying Standard; *L. Arons,* Serial Learning and Generalizing Abstraction; *S. J. Beck,* Configurational Tendencies in Rorschach Responses; *E. A. Doll,* Psychological Significance of Cerebral

Birth Lesions; *F. C. Thorne* and *K. M. Dallenbach*, Spatial Perception in the Region of the Optic Disk; *F. L. Dimmick*, The Dependence of Auditory Experience upon Wave Amplitude; *J. G. Jenkins*, Instruction as a Factor in 'Incidental' Learning; *M. C. Barlow*, The Influence of Electric Shock in Mirror Tracing; *G. A. Fry*, Modulation of the Optic Nerve-Current as a Basis for Color-Vision; *M. B. Mitchell*, The Effect of Serial Position in the Continuous Memorization of Numbers; *W. Spence* and *J. P. Guilford*, The Affective Value of Combination of Odors.

PSYCHOLOGICAL REVIEW, XL, 4: *Raymond H. Wheeler, F. Theodore Perkins*, and *S. Howard Bartley*, Errors in the Critiques of Gestalt Psychology III. Inconsistencies in Thorndike's System; *J. R. Kantor*, In Defense of Stimulus-Response Psychology; *Saul Rosenzweig*, The Experimental Situation as a Psychological Problem; *Edwin R. Guthrie*, Association as a Function of Time Interval; *Carlos Kling*, The Rôle of the Parasympathetics in Emotions; *Miles A. Tinker*, Use and Limitations of Eye-Movement Measures of Reading; *Edward M. Brecher*, Conatus In Spinoza's Ethics.

JOURNAL OF EXPERIMENTAL PSYCHOLOGY, XVI, 3: *R. W. Bruce*, Conditions of Transfer of Training; *I. Lorge*, The Effect of the Initial Chances for Right Responses upon the Efficacy of Intensified Reward and of Intensified Punishment; *I. Lorge*, The Comparative Strengthening of a Connection by One or More Occurrences of It in Cases Where the Connection was Punished and was Neither Punished nor Rewarded; *G. W. Hartman*, The Increase of Visual Acuity in One Eye Through Illumination of the Other; *G. W. Hartman*, Changes in Visual Acuity Through Simultaneous Stimulation of Other Sense Organs; *C. E. Ferree, G. Rand* and *E. T. Harris*, Intensity of Light and Area of Illuminated Field as Interacting Factors in Size of Pupil; *A. C. Anderson*, Runway Time and the Goal Gradient; *R. H. Waters* and *G. B. Poole*, The Relative Retention Values of Stylus and Mental Maze Habits; *R. W. Brown*, The Relation between Two Methods of Learning Piano Music; *E. R. Hack*, Learning as a Function of Water Temperature; *H. R. Crosland*, A Technique to Control, and to Measure the Effects of Fixation in the "Range of Attention" Experiment; *C. E. Lauterbach*, An Improved Technique in the Mirror-Tracing Experiment.

PSYCHOLOGICAL BULLETIN, XXX, 5; *Abraham Gronbach*, The Psychology of Religion. 6: *Floyd L. Ruch*, Adult Learning; *Edward B. Van Ormer*, Sleep and Retention.

THE MODERN SCHOOLMAN, X, 4: *Pietro Pirri*, Italy; Scholarship; *Georges Delannoye*, Belgium; *Andre Bremond*, France; *Dionisio Dominguez*, Spain; *Erich Przywara*, Germany; *Martin C. D'Arcy*, England and Ireland; *John F. McCormick*, America.

REVUE DE MÉTAPHYSIQUE ET DE MORALE, XL, 2: *J. Lequier*, Prescience et Liberté, avec introduction par L. Dugas; *E. Geismar*, La personnalité de Kierkegaard; *J. Ghéréa*, Le Moi et le Monde; *L. Blanchet*, La préparation du "Cogito" cartesien dans la philosophie grecque.

REVUE PHILOSOPHIQUE, LVIII, 5 et 6: *A. Spaier*, Cruauté, violence et colère; *L. Basso*, La science, la technique et la société; *Ch. Adam*, Corre-

spondance de Descartes, Nouveau classement. *W. Drabovitch,* La bio-psychologie de R. Avenarius et le problème de "l'Homme total"; *J. Peres,* Le temps, L'instant et le rôle des sensations auditives.

REVUE D'HISTOIRE DE LA PHILOSOPHIE ET D'HISTOIRE GENERALE DE LA CIVILIZATION, I, 1: *H. Jeanmaire,* Introduction à l'étude du livre II du *De natura deorum; Leo Spitzer,* Goethe et Racine; *Henri Gouhier,* Le premier maitre d'Auguste Comte: Daniel Encontre.

LOGOS, XVI, 1: *M. F. Sciacca,* Dio Nella filosofia di T. Reid; *G. D'Eufemia,* Il rapporto tra stato e diritto secondo il Wundt; *G. Galli,* Il problema dell'universale-particolare; *M. Di Domenico,* Moralità e libertà in una concezione estetica dell'universo. 2: *O. Muscato,* La Religione e lo Stato nell'antichità; *E. Vigorita,* Antonio Genovesi; *G. Capone-Braga,* Il significato delle "Metamorfosi" di Apuleio; *E. Garin,* Polemiche sulla nozione dello spazio nei sec. XVII e XVIII; *P. C. Drago,* Immortalità e sopravvivenze; *C. Carbonara,* Morale e religione nella filosofia di H. Bergson; *G. Migliorino,* L'ansietà costituzionale.

GIORNALE CRITICO DELLA FILOSOFIA ITALIANA, XIV, 2: *U. Spirito,* La scienza e il problema teologico; *F. Lombardi,* Intorno al concetto della dialettica; *G. Maggiore,* Il sentimento nel diritto; *E. Bignami,* Problemi vari sulla poetica di Aristotele; *G. Lo Gullo,* Carlo Cattaneo e l'idea della processualita del reale; *C. Diano,* Il titolo "De finibus bonorum et malorum".

RIVISTA DI FILOSOFIA NEO-SCOLASTICA, XXV, 2: *A. Masnovo,* Gnoseologia e metafisica; *V. Romanelli,* Intorno al significato del concetto di filosofia cristiana; *P. Rotta,* A proposito della questione platonica; *M. E. Dal Verme,* Osservazioni sul concetto di miracolo in Hume; *S. Vanni Rovighi,* L'attributo spinoziano e la dimostrazione dell'uninicita della sostanza; *A. Bestetti,* La metafisica dell'anima nei rapporti con la teoria del conoscere in Antonio Rosmini; *U. A. Padovani,* L'importanza della critica filosofica di Serafino Sordi a Vincenzo Gioberti; *M. Casotti,* Alcune osservazioni sulla "scuola attiva"; *A. Padoa,* Logica ideografica.

ARCHIVIO DI FILOSOFIA, III, 1: *F. Orestano,* Scienza e poesia nel Novecento; *E. Castelli,* Idealismo e Solipsismo; *A. Pastore,* Ricerche logiche con applicazione al problema fondamentale della fisica teorica; *F. Lombardi,* Interno al concetto della "cosa in se"; *G. M. Ferrari,* Leibniz filosofo della natura.

REVISTA DE PSICOLOGIA I PEDAGOGIA, I. 1: *E. Mira,* Assaig psicologic sobre el dolor; *W. H. O. 'N. Manning,* Estudi psicològic del medi fisic dels obrers; *C. de Inza,* La psicotecnia en los ferrocarriles; *C. Soler Dopff,* La importància de l'autoestimació; *C. Cardenal 1A. Granada,* L'eficàcia del consell orientador.